SPECTRAL DYNAMICS

MODEL 2521

DIV. OF SCIENTIFIC-ATLANTA

MP MASTER
MA29766

MODEL 2521
Tracking Vibration Recorder

Service Manual

METRUM
INSTRUMENTATION SERVICES
370 Bernardo Ave. Mountain View, CA 94043
A Business of Alliant Techsystems Inc.

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CERTIFICATION
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General Information

1.1 INTRODUCTION

This manual provides service personnel with the required information for understanding, maintaining and calibrating the Model 2521 Tracking Vibration Recorder. Section 1 contains a general description and engineering specifications. Section 2 contains descriptions of controls, connectors, indicators and operating modes and procedures. Section 3 contains block diagrams and circuit descriptions. Section 4 contains calibration and maintenance procedures including recorder cabling. Section 5 contains schematic diagrams and replaceable parts lists. This manual should be read before servicing the Model 2521.

1.2 GENERAL DESCRIPTION

The Model 2521 Tracking Vibration Recorder is designed to measure both broadband or overall and spectral vibration. Inputs are provided using an accelerometer having internal electronics. Broadband velocity is read on a meter while spectral velocity versus frequency is read and plotted on 4 in. x 6 in. signature cards using the self-contained X-Y recorder. Operating modes are defined as Broadband, Automatic Vibration Signature, Manual Tuning, Frequency Tracking and Performance Verification.

The instrument operates from 115/230 Vac power or internal rechargeable batteries. A self-contained charging circuit continually charges the batteries when the unit is connected to ac power.

The Model 2521 Tracking Vibration Recorder is designed as a portable predictive maintenance tool. As a vibration recorder, it can be used to survey machinery vibration by periodically making vibration signature plots. By observing these plots over periods of time, a trend history can be established for machine systems. This trend history is useful for machine system performance evaluation and prediction of failure.

In addition to measuring vibration the Tracking Vibration Recorder when combined with a balancing option can be used to correct rotor mass unbalance. Optional signal conditioners can be used to measure and record other parameters such as displacement, pressure and torsional vibration.

A standard shipment consists of:

1. Accelerometer (9952)
2. Accelerometer cable (9194)

3. Magnet (9195)
4. 200 signature cards (10304-1)
5. Recorder pens (2 each black, red, green, blue)
6. Carrying strap (9490)

1.3 ENGINEERING SPECIFICATIONS

1.3.1 Model 2521 Tracking Vibration Recorder

Velocity Ranges: 0.2, 1.0 and 5.0 ips peak FS
Velocity Amplitude Accuracy: ± (2% FS + 3% Value) excluding accelerometer
Frequency Ranges: 9K cpm (150 Hz) or 90K cpm (1500 Hz)
Frequency Accuracy: ± (2% FS + 3% Value)
Filter Bandwidth: 2.5 Hz in 150 Hz range, 15 Hz in 1500 Hz range
Filter Bandwidth Accuracy: ± 5%
Frequency Response: ± 2% 5 Hz - 1500 Hz, 3db down at 2.5 Hz and 2100 Hz
Frequency Tracking Rate: 1 Hz/sec max in 150 Hz range
20 Hz/sec max in 1500 Hz range
Recording Time: 60 ± 6 sec for signature plots
Power Required: 115/230 Vac, 50-400 Hz, 2VA or internal rechargeable Ni-Cd battery pack
Battery Life: 100 recordings (min.); 3 hours continuous operation in Manual Tuning and Frequency Tracking modes; 40 hours in Broadband mode
Battery Recharge Time: 14 - 16 hours
Operating Temperature: 10° to 122°F (-12° to 50°C)
Charging Temperature: 50° to 120°F (10° to 49°C)
Dimensions: 10¼" D x 14¼" W x 10" H (260 mm D x 362 mm W x 254 mm H)
Weight: 18 lbs. (8.2 Kgs)

1.3.2 Model M762-1 Strobe Light (Optional)

Input Pulse:

Source: Model 2521
Polarity: Positive
Minimum Amplitude: 3V
Maximum Rise Time: 20 µs
Minimum Pulse Width: 200 µs
Frequency: 0 - 1677 Hz (100k cpm)
Trigger Phase Adjust: Continuous 1 turn, adjusts phase shift over 350 degree range.
Output Flash Energy: 60 mj/flash
Output Flash Duration: 4 µs
Power Required: 115 Vac @.1A, 230 Vac @.05A, 12 Vdc Internal battery pack
Battery Life: 1 hour at max. frequency rate
Battery Recharge Time: 14 - 16 hours
Operating Temperature: -40° to 140° F (-40° to 60°C)
Charging Temperature: 50° to 120°F (10° to 49° C)
Weight: 6 lbs. (2.72 Kgs)

Operation

2.1 INTRODUCTION

This section contains functional descriptions of the controls, connectors, indicators and the X-Y recorder. It also contains descriptions of operating modes and procedures.

2.2 DESCRIPTION OF CONTROLS, CONNECTORS AND INDICATORS

The following paragraphs describe the controls, connectors and indicators shown in Figure 2-1.

1. BAT ± LED Indicators - Indicate charging current is being supplied to ± battery packs.

2. BAT Pushbutton Switch - Loads batteries and uses green band on Velocity Meter to indicate charge condition.

3. VELOCITY Meter - Indicates peak broadband velocity and battery charge condition.

4. STR Connector - Provides a strobe trigger at the frequency to which the unit is tuned. Provides additional connection for externally adjusting the phase between the vibration input signal and the strobe trigger.

5. FREQUENCY Hz/CPM (150/9K, 1500/90K) Switches - Interlocked pushbutton switches for selecting 150/9K or 1500/90K Hz/CPM frequency range, and 2.5/150 or 15/900 Hz/CPM bandwidth, respectively, and for setting the Recorder horizontal axis full scale sensitivity during spectral analysis.

6. VELOCITY MULTIPLIER (0.2, 1.0, 5.0) Switches - Interlocked pushbutton switches for selecting 0.2, 1.0 or 5.0 as velocity multiplier thereby setting the velocity meter and Recorder vertical axis full scale sensitivity.

7. OFF Pushbutton Switch - Turns off power. If pressed while the recorder is being used the pen will return to the load position before power is turned off.

8. MAN Pushbutton Switch - Selects the manual tuning operating mode.

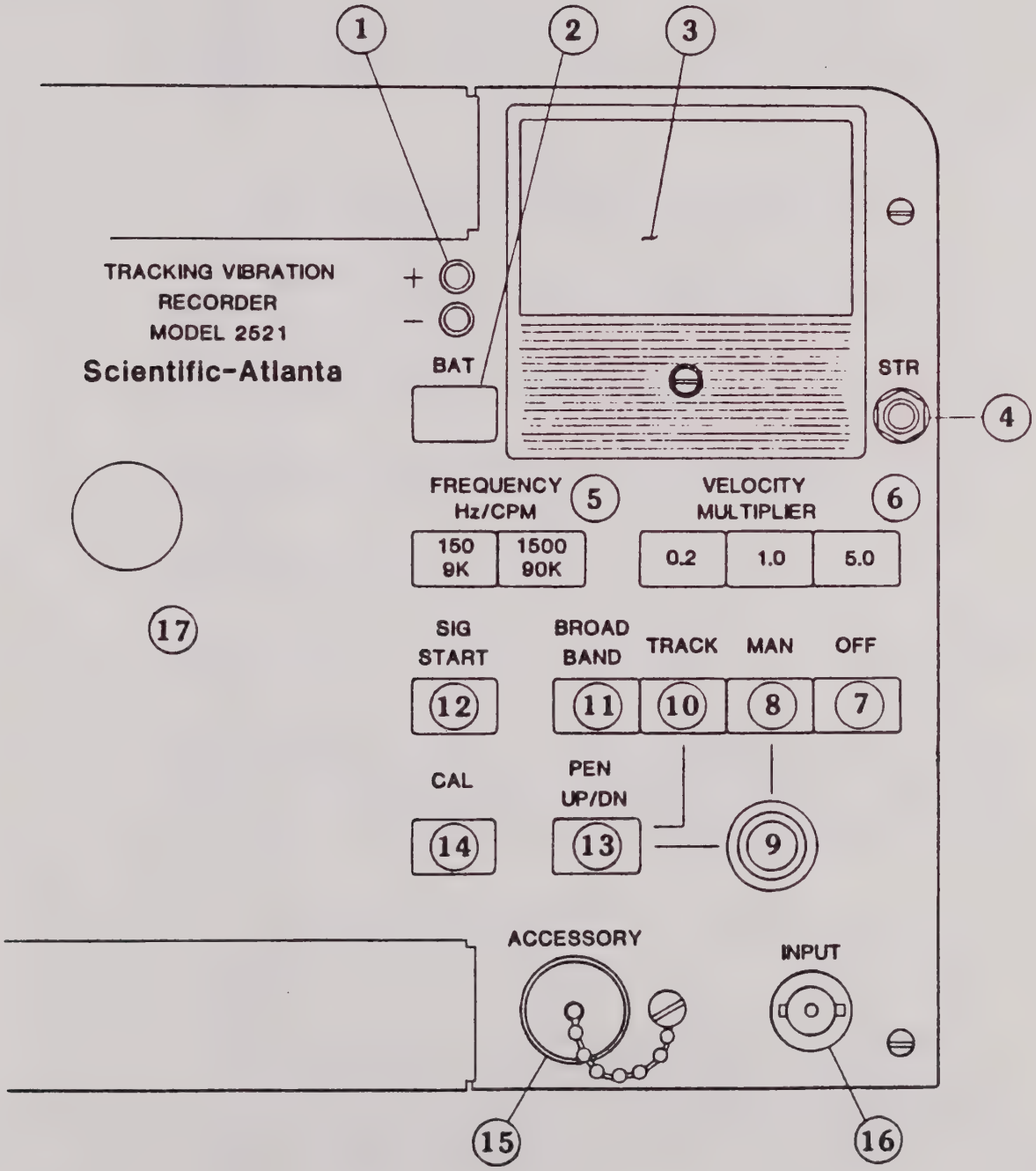

Figure 2-1. Controls, Connectors and Indicators.

9. MAN Tuning Control - Controls the frequency tuning in the manual tuning operating mode.

10. TRACK Pushbutton Switch - Selects the track operating mode.

11. BROADBAND Pushbutton Switch - Selects the broadband operating mode.

NOTE

OFF, MAN, TRACK and BROADBAND are interlocked pushbutton switches.

12. SIG START Pushbutton Switch - Starts the automatic vibration signature recording. Must be in Broadband operating mode.

13. PEN UP/DN Pushbutton Switch - Controls the position of the pen in the manual tuning and track operating modes. Pressing this switch will cause the pen to move to its opposite position.

14. CAL Pushbutton Switch - Enables a calibrate signal of known frequencies and amplitudes to be applied to the input to verify performance of the instrument.

15. ACCESSORY Connector - Provides power and signal path for optional signal conditioners.

16. INPUT Connector - Provides bias power and signal path for input accelerometer.

17. X-Y RECORDER - Provides readout and recording of spectral velocity and frequency in the Manual Tuning and Track operating modes. Provides automatic vibration signature recording in the Broadband operating mode when Sig Start is pressed. Velocity and frequency scales are provided by preprinted Signature Cards.

2.3 OPERATING MODES

The following sections describe the various operating modes.

2.3.1 BROADBAND

The Broadband mode is selected by pressing the BROADBAND pushbutton switch. This mode measures the broadband or overall peak vibration velocity from 150 cpm to 126K cpm. The broadband velocity is indicated on the VELOCITY meter with full scale sensitivity determined by the VELOCITY MULTIPLIER pushbuttons.

2.3.2 AUTOMATIC VIBRATION SIGNATURE

The Automatic Vibration Signature mode is selected by first pressing the BROADBAND pushbutton and then pressing the SIG START pushbutton. Pressing these controls will cause the pen, after 5 seconds, to move slowly along the horzontal

axis. First the frequency range and then the velocity multiplier are automatically marked. The recorder will then make a plot of vibration velocity vs frequency. After 60 seconds the pen will lift and return to the lower left rest position. The OFF pushbutton can be used to terminate a plot early.

2.3.3 MANUAL TUNING

The Manual Tuning mode is selected by pressing the MAN pushbutton switch. Approximately 3 seconds after the button is pressed the recorder will respond. The pen will move to a position indicating the tuned frequency and the vibration velocity at that frequency. The velocity in inches per second peak and frequency in Hz and cpm are read from Signature Card vertical and horizontal axis, respectively.

The MAN Tuning Control located below the MAN pushbutton switch is used to change the frequency tuning after the frequency range is selected using the FREQUENCY pushbutton switches. The vertical axis full scale sensitivity is selected using the VELOCITY MULTIPLIER pushbutton switches.

The PEN UP/DN pushbutton switch will control the pen position in this operating mode. The VELOCITY Meter will continue to read Broadband Velocity with the full scale sensitivity equal to that of the vertical axis.

2.3.4 FREQUENCY TRACKING

The Frequency tracking mode is selected by pressing the TRACK pushbutton switch. The Frequency Tracking mode is useful in locking on to a vibration frequency and tracking the signal if it should change in frequency. As long as the velocity amplitude exceeds 5% FS when Frequency Tracking is selected the instrument will automatically lock on to that vibration signal. If the frequency changer and the amplitude falls below 5% FS the recorder will stop moving the horizontal axis will indicate the frequency at which the unit stopped tracking.

The VELOCITY meter, FREQUENCY, VELOCITY MULTIPLIER, and PEN UP/DN pushbuttons and STR connector operate the same as in the Manual Tuning Mode. The instrument will track frequency changes up to 1 Hz/sec in the 150 Hz range and 20 Hz/sec in the 1500 Hz range.

The Frequency Tracking mode is most effective when used in conjunction with the Manual Tuning. By tuning to a signal of interest in the Manual Tuning mode and then pressing TRACK one can monitor amplitude and frequency changes.

2.3.5 PERFORMANCE VERIFICATION

The Performance Verification mode is selected by operating in the Manual Tuning, Track or Automatic Vibration Signature and pressing the CAL pushbutton. When the CAL pushbutton is pressed and held, a signal is generated and connected to the input.

2.4 OPERATING PROCEDURES

2.4.1 OPEN/REMOVE CASE COVER (Refer to Figure 2-2)

To open the case cover release the two latches located above the model identification label and swing it back to the rest position. To remove the cover secure the cover with two hands, exert pressure toward hinges and to the right. The hinges will separate and the cover will be free. To attach the cover secure as before. Line up the two hinges and exert pressure to the left until a click is heard.

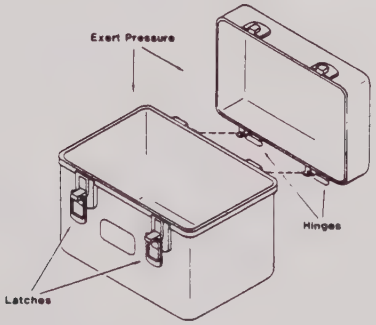

Figure 2-2 Open/Remove Case Cover

CAUTION

Do not place heavy objects in the open case cover. Excessive weight may damage hinges.

2.4.2 SIGNATURE CARD INSERTION (Refer to Figure 2-3)

The signature card is retained by two black card guides and a black spring loaded hinge retainer. To insert a signature card, hold the right edge of the card in the right hand. Lift the hinged retainer by exerting upward pressure on the lifting tab at the extreme left using the left hand. Slide the card under the hinged retainer and then into the two card guides. Release the hinged retainer when card is firm against the card guides. A finger hole is provided for removal of the card in reverse order of inserting the card.

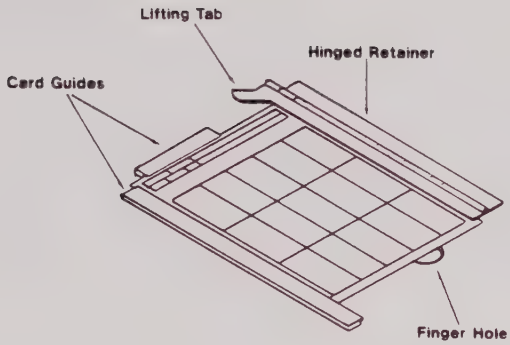

Figure 2-3 Signature Card Insertion

NOTE

Do not insert and remove cards while recorder is in use. Pen holder should be in the lower left rest position and up during these procedures.

Do not move pen holder manually.

2.4.3 RECORDER PEN INSERTION (Refer to Figure 2-4)

Whenever the recorder is to be used a pen should be inserted in the recorder pen holder. First select a pen from the pen storage located in the storage cover or the small compartment under the storage cover. Turn the storage cover latch counter clockwise to open the cover. Remove pen cap and store on top of the cable storage posts. Hold the pen in the right hand. Support the pen holder with the left hand and insert the pen into the pen holder until it stops. Turn ¼ turn in either direction. To remove the pen turn ¼ turn and lift from pen holder.

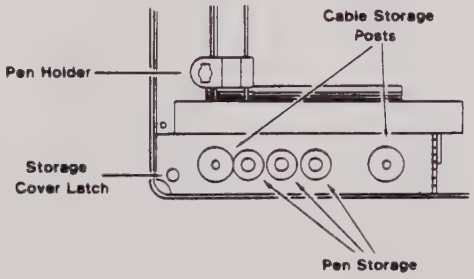

Figure 2-4 Recorder Pen Insertion

NOTE

Do not insert and remove pens while recorder is in use. Pen holder should be in the lower left rest position and up during these procedures.

Do not close case cover with pen in pen holder.

2.4.4 POWER SELECTION

The Model 2521 is designed to operate from 115/230 Vac line power or internal rechargeable ni-cad battery packs. To operate from ac power the line cord located in the storage compartment must be plugged into the proper receptacle. The battery packs are trickle charged whenever the line cord is connected to ac power as indicated by the BAT ± LED indicators. The unit operates from the internal battery packs whenever the line cord is not connected to ac power.

CAUTION

An internal switch is set to the proper voltage 115 or 230 prior to shipment of the unit. Refer to Section 2.5 for locating and checking the voltage setting.

2.4.5 BATTERY TEST

Pressing the BAT pushbutton allows the VELOCITY meter to indicate battery voltage under load. The meter will indicate about 0.8 after 14 to 16 hours of charging. After some battery useage it will fall to about 0.7 and remain there until the batteries require recharge.

NOTE

Hold the BAT pushbutton for 5 - 10 seconds to observe if the indication holds steady.

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Theory of Operation

3.1 INTRODUCTION

This section contains a discussion of the theory of operation. Block diagrams and timing diagrams are included and referenced to assist in understanding the detailed description of the schematic diagrams contained in this section. This section should be read and understood before attempting any troubleshooting of the instrument.

3.2 SIMPLIFIED BLOCK DIAGRAM (Refer to Figure 3-1)

The Model 2521 is a low frequency, heterodyne type spectrum analyzer. It has the capability of being automatically swept or manually tuned. Specific vibration components can also be tracked as frequency or amplitude change. An ACCELEROMETER provides the vibration input to an input switch. A BIAS circuit provides the accelerometer bias. The input switch, controlled by the CAL pushbutton, applies either the vibration input or the calibrate signal to the INPUT SIGNAL CONDITIONER. The Input Signal Conditioner contains high pass and low pass filters to reject those frequencies not of interest and an integrator to convert acceleration to velocity. The VELOCITY MULTIPLIER controls the gain of the input signal conditioner and 1st modulator. The velocity signal is then applied to a BROADBAND DETECTOR and the 1st MODULATOR. The detected output is applied to the METER SWITCH that controls the drive to the VELOCITY METER. The BAT pushbutton rewires the Meter Switch and Velocity Meter to indicate the battery charge condition under load.

The 1st Modulator mixes the velocity signal from the input signal conditioner with the output from the VOLTAGE CONTROLLED OSCILLATOR (VCO). The output of the VCO will sweep from 2000 to 2150 Hz in the 150 Hz frequency range and from 2000 to 3500 Hz in the 1500 Hz range. The VCO is controlled either by the TRACK PHASE DET, RAMP GENERATOR or MAN TUNE CONTROL.

The output from the 1st Modulator is applied to the 1st IF FILTER. The IF FILTER consists of three identical bandpass filter stages tuned to 2000 Hz. The output of the 1st IF FILTER is mixed with the 1800 Hz signal from the REFERENCE OSCILLATOR in the 2nd MODULATOR. The output of the 2nd Modulator is applied to the 2nd IF FILTER AND DETECTOR. The 2nd IF Filter consists of three bandpass filter stages tuned to 200 Hz. The pressed FREQUENCY pushbutton determines the overall filter bandwidth, namely, 2.5 Hz in 150 Hz position and 15 Hz in the 1500 Hz position. The detected Velocity signal is connected

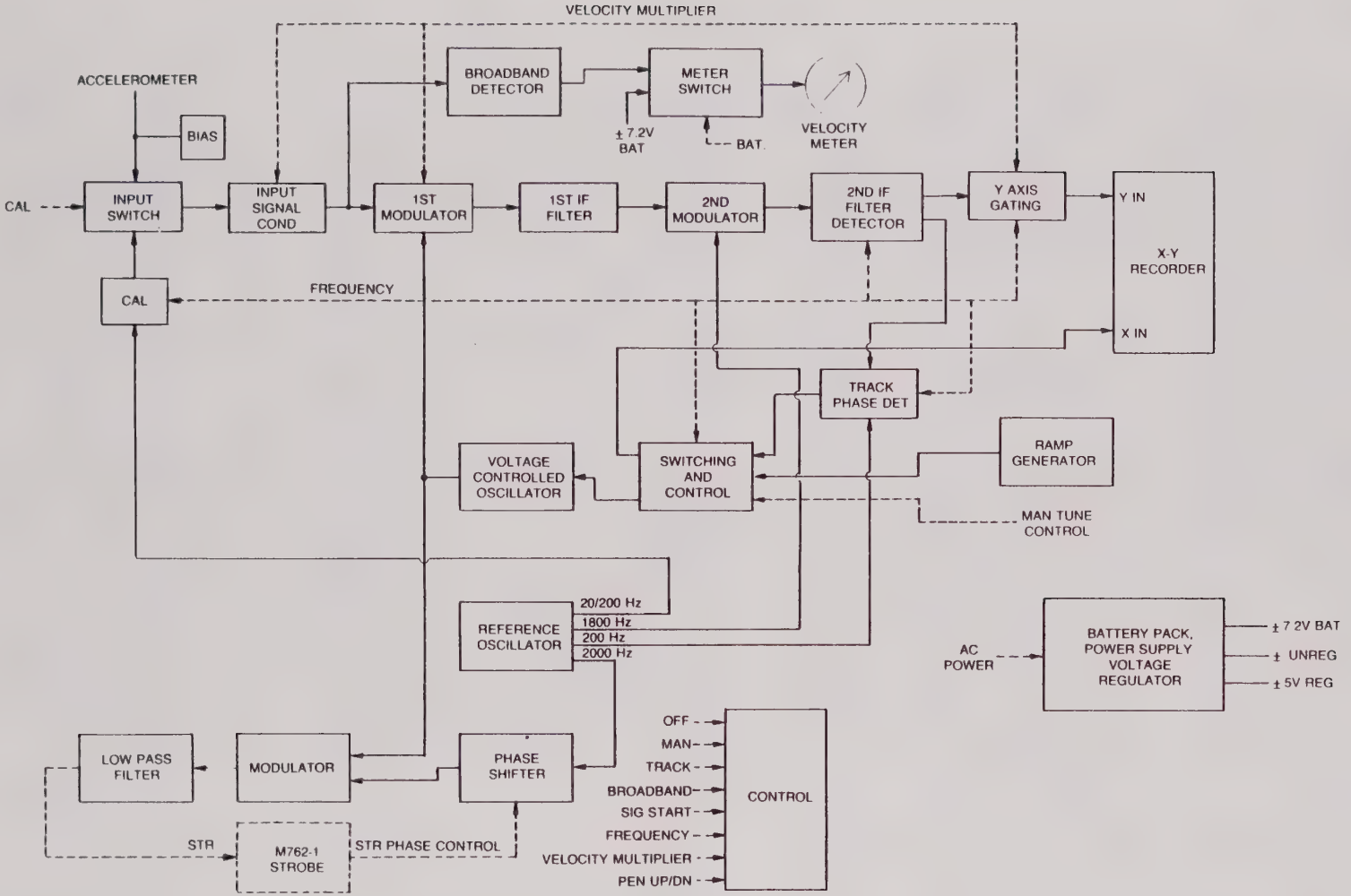

Figure 3-1 Simplified Block Diagram

to the Y AXIS GATING circuit. In the MANUAL or TRACK modes the gating circuit always routes the detected voltage to the recorder. When in the SIGNATURE mode, the frequency and velocity multiplier information are routed to the recorder early in the sweep and recorded on the card.

The CONTROL block generates all the timing required to define the operation of the instrument in any mode. It also contorls on/off switching of the VOLTAGE REGULATOR and distribution of its ±5V REG outputs.

In the Manual or Track Mode, the control logic routes the Manual Tuning Control to the VCO and X axis drive. In the Signature Mode, the ramp generator is routed to the VCO and X axis drive. When the Track button is pressed, a feedback loop is closed which controls the VCO in a way to center tune the analyzer. This is done by comparing the 200 Hz output of the 2nd IF filter with a 200 Hz reference signal. When the two signals are the same, a phase-lock condition exists that center tunes the filter. Under these conditions the recorder will track frequency changes at the input.

The REFERENCE OSCILLATOR generates 20/200 Hz used to make the calibrate signal, 1800 Hz used in the 2nd modulator/the 200 Hz input to the track phase detector and 2000 Hz used to make a strobe trigger, STR.

The strobe trigger is made by mixing 2000 Hz and the VCO output in the MODULATOR and then passing it through a LOW PASS FILTER. The PHASE SHIFTER controls the phase relationship between the strobe trigger and the input vibration signal. The M762-1 Strobe contains a trigger phase adjust dial that controls the phase shifter.

The BATTERY PACK, POWER SUPPLY, VOLTAGE REGULATOR block generate both ±UNREG and ±5V REG from either ac or battery power.

3.3 BLOCK DIAGRAM (Refer to figure 3-2)

This block diagram presents a more detailed picture of the circuits within the instrument. Schematic diagrams contained in Section 5 are referenced to identify where specific circuitry may be found. Control lines are identified and labeled consistent with the Timing Diagrams Figures 3-3 and 3-4 and the Schematic Diagrams Figures 5-2 through 5-14.

3.4 MAIN FRAME DESCRIPTION (Refer to figure 5-1)

The Model 2521 consists of 5 circuit boards: Signal, Control, X-Y Recorder, Panel and Power Supply. Three ribbon cables are used to connect the 5 circuit boards. One cable is terminated by P4, P7 and P15. P9, P10 and P13 terminate the second cable. The third cable is terminated by P8 and P12. Conventional harnesses are used to connect the X-Y Recorder board to the front panel recorder assembly and to connect the Input, Accessory and STR connectors to circuit boards.

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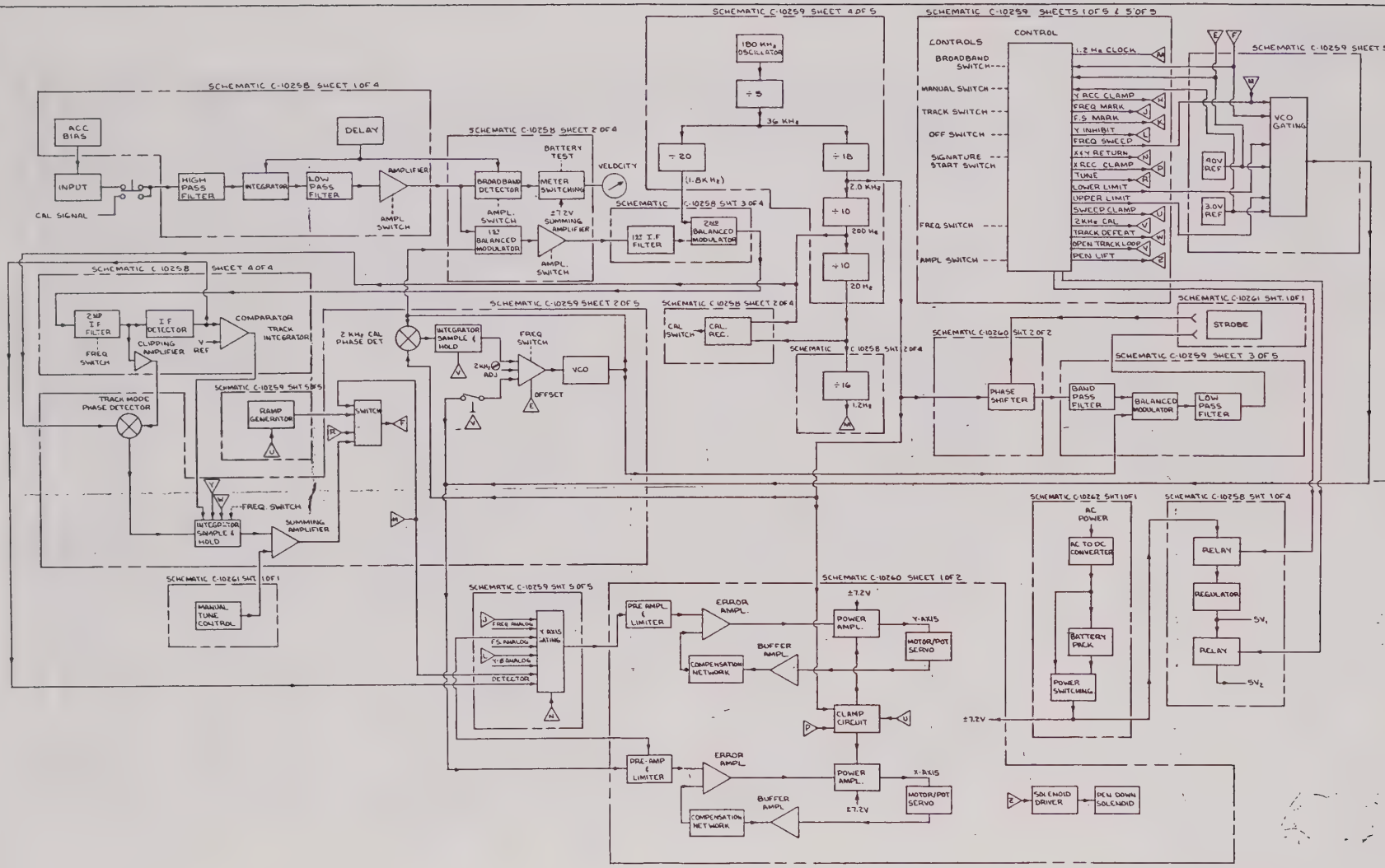


BLOCK DIAGRAM, DETAILED

DRAWN MJM	DATE 10 29 81	CODE IDENT NO 13048	Scientific Atlanta
SIZE		SHEET 1 OF 1	DWG NO D-10256
MODEL 2521			

3.5 SIGNAL BOARD CIRCUIT DESCRIPTION

The Signal Board contains the following functions:

1. Input Signal Conditioning, Voltage Regulation
2. Broadband Detection, 1st Modulator, Calibration
3. 1st IF Filter, 2nd Modulator
4. 2nd IF Filter, IF Detection

3.5.1 Input Signal Conditioning, Voltage Regulation (Refer to Figure 5-2)

When the MAN TRACK or BROADBAND pushbuttons are pressed, relays K3 and K4 are energized connecting the ± unregulated voltage to the voltage regulator. The ±5V outputs of the voltage regulator supply the signal conditioning circuitry and the broadband meter circuitry directly. The other circuitry receives ±5V through relays K1 and K2. These relays are energized when the MAN, TRACK or SIG START pushbuttons are pressed. K1 and K2 continue to be energized when going from MAN or TRACK to OFF or BROADBAND until the pen carriage travels to the lower left rest position. These relays are driven by a set-reset flipflop consisting of Q4, Q5 and associated circuitry.

Separate regulating circuits using a common voltage reference provide constant ±5V to the Analyzer. CR11 is a 6.2V zener reference diode which is biased from the + unregulated supply by constant current source Q7. Error amplifier IC4B and series pass transistor Q9 control the -5V regulation. Pin 6 is held at ground potential by the negative feedback and ground reference at pin 7. R33 adjusts the -5V regulated output. The +5V regulator uses the -5V supply as a reference, IC4A as a unity gain inverter and Q8 being the pass transistor. Since the output of IC4 cannot swing the entire range of its ± unregulated supplies, diodes CR12 and CR13 are used to shift the pass transistor base control voltage to a level that is within the output swing capability of the IC.

The input accelerometer is connected to the Model 2521 using INPUT connector J1 which is tied to connector J14 Pin 4. The accelerometer internal amplifier is based at 0.5 mA constant current and 13.5Vdc. The bias network consists of constant current source Q1 and IC1B connected as a 20 KHz oscillator used to convert from 5V to 14.5V.

The frequency range is limited to below 10 KHz by bypass capacitor C1. The 3 pole high pass filter consisting of IC2A, C4, C5, R2, R3, C8 and R7 determines the lowend frequency response of -3dB at about 2.5 Hz. IC2B and its associated components, R8 and C10, integrate the filtered signal to produce a voltage proportional to velocity.

Q3 serves as a switch to clamp the output of IC2B during power up to minimize transient feed through to the following circuitry.

The high end frequency response of -3 dB at about 2100 Hz is determined by the LP filter consisting of IC2C and associated components. Variable gain amplifier IC3A is controlled by pressing the VELOCITY MULTIPLIER pushbuttons. The gain is 6.0 when either the 0.2 or 1.0 pushbutton is pressed and 1.2 when the 5.0 pushbutton is pressed. IC3A is used to change gain.

3.5.2 Broadband Detection, 1st Modulator, Calibration (Refer to Figure 5-3)

The output from the Input Signal Conditioning circuit is ac coupled to peak detector IC5A and inverting amplifier IC6A. Low pass filter, R44 and C23, averages the detector output to a dc level. The dc level is then buffered by variable gain amplifier IC5B which in turn drives the VELOCITY METER. The amplifier gain is controlled by the VELOCITY MULTIPLIER push buttons. When the 0.2 pushbutton is pressed the gain is 15.75. The gain becomes 3.15 when either the 1.0 or 5.0 pushbutton is pressed. The gain is controlled by IC3D. The amplifer output is normally connected to the VELOCITY METER. When the BAT pushbutton is pressed a load resistor is wired across the battery pack and the meter is wired to measure battery pack voltage. Refer to R6 on Figure 3-14, Q11 and Q12 on Figure 3-11 and S8A on Figure 3-13.

The 1st Modulator consists of inverting amplifier ICA, bilateral broadband switches IC7A and IC7B and variable gain summing amplifier IC6B. The input to IC6A and the inverted output are feed to switches IC7A and IC7B, respectively. These switches are controlled by two signals, VCO ϕ1 and VCO ϕ2, which are generated by the VCO and are 180° out of phase. The summing amplifier combines the switching action to produce a signal that contains sum and difference frequencies of the input signal and the VCO frequency components. The summing amplifier gain is controlled by Velocity Multiplier push buttons. The Modulator gain is .25 when either 1.0 or 5.0 is pressed and 1.27 when 0.2 is pressed.

Bilateral switches IC3B and IC3C are used to generate the calibrate signal at J14 Pin 3. When the CAL pushbutton is pressed and held IC3B will be clocked by the 20 Hz square wave at J13 Pin 8 if the 150 Hz Frequency pushbutton had been pressed. If the 1500 Hz pushbutton had been pressed the IC3C will be clocked by the 200 Hz square wave at J13 Pin 7. The calibrate signal will be either 20 Hz or 200 Hz of the proper amplitude depending on the FREQUENCY pushbutton that is pressed. Resistor dividers determine amplitude.

3.5.3 1st IF Filter, 2nd Modulator (Refer to Figure 5-4)

The 1st IF Filter consists of three identical cascaded stages so only a detailed description of one of them is necessary. One filter stage consisting of IC8 and associated components constitute an active bandpass filter. The center frequency of this stage is controlled by R66, R67, R69, R70, R71, C26 and C27 and can be tuned to the 1st IF frequency of 2 KHz using R67. The 3 dB bandwidth is approximately 88 Hz. All stages have ac gain of unity at 2 KHz. The filter output goes to the 2nd modulator.

The 2nd modulator works the same as the first modulator described in Section 3.4.2. Amplifier IC11A, IC12A, B, C and D and amplifier IC11B act as inverter, switches and summing amplifier, respectively. The switches are clocked by 1800 Hz $\phi 1$, and 1800 Hz $\phi 2$, generated by the Reference Oscillator, which are 180° out of phase. The gain of this modulator is 0.98. The modulator output goes to the 2nd IF filter.

3.5.4 2nd IF Filter IF Detector (Refer to Figure 5-5)

The 2nd IF Filter consists of three functionally identical cascaded stages so a detailed description of one of them will suffice.

One filter stage consisting of IC13 and IC14 constitutes an active bandpass filter with switchable bandwidths. The center frequency of this stage is controlled by R98, R99, R100, C34, R94, R95, C35 and can be tuned to the 2nd IF frequency of 200 Hz using R95. When the 150 Hz FREQUENCY pushbutton switch S9 is pressed, all IC14 switches are turned off removing R92 and R97 from the circuit leaving R93 and R96 to set the gain to unity and bandwidth to 5 Hz. Pressing the 1500 Hz Frequency pushbutton switch S10 turns on IC 14 switches placing R92 in parallel with R93, and R97 in parallel with R96. This changes the bandwidth to approximately 30 Hz without substantially changing the transfer gain. Cascading three filters produces an overall bandwidth of 2.5 Hz and 15 Hz as specified in Section 1. The gain of the first stage at the center frequency is unity. The gain of the second stage is set by R105 and R102 at two. The third stage gain, set by R114 and R111 is four. The overall gain should be approximately eight. The filter output is fed to the IF Detector and squaring amplifier IC18D.

The IF Detector is a variable gain full wave detector, followed by a 2 pole LP filter. The detector consists of IC19A and IC19B and associated components. The filter consists of IC19C and associated components. The detector output offset is controlled by R123 and R122. The gain of the detector can be adjusted by R131 when switch IC20B is closed by pressing the 150 Hz FREQUENCY pushbutton. R130 is used to adjust the gain when switch IC20A is closed by pressing the 1500 Hz FREQUENCY pushbutton. The output

of the IF Detector goes to threshold detector, IC19D, that indicates when the detector output exceeds 5% FS. The detector output also goes to the XY Control Logic on Figure 5-10.

3.6 CONTROL BOARD CIRCUIT DESCRIPTION

The Control Board contains the following functions:

1. Load Sequence, Pen Lift Control
2. VCO, Refresh, Track
3. Strobe Trigger Modulator, LP Filter
4. Reference Oscillator, Pushbutton Detector
5. Sweep Sequences, X-Y Control Logic

3.6.1 Load Sequence, Pen Lift Control (Refer to Figures 3-3 and 5-6)

Power on reset is generated by IC5A. Prior to power up, C1 is discharged through CR6 and the +5V regulator circuit. When power is applied the output of IC5A goes to the positive stop. The output remains positive until C1 charging causes pin 6 to pass through OV at which time the output goes to the negative stop. This reset is generated in the Broadband mode when Sig Start is pressed.

The power on reset pulse resets sequence shift register IC1, pen lift flipflop IC6A and power off flipflop IC4A. When reset, the outputs of the shift register are logic 0. As the shift register is clocked by the 1.2 Hz ref the outputs will go to logic 1 since the Data input is held at logic 1. The first clock pulse causes IC1B Q1 to go to logic 1 and the outputs of exclusive or gates IC3C and IC3A to go to logic 1 thus defining the beginning of phaselock, XY return interval and sweep clamp, respectively. If Sig Start is used to power up this circuitry the output of NOR gate, IC2B is always logic 0. Therefore, NOR gates IC2C and IC2D function as inverters and generate X and Y axis inhibit signals, respectively. The X and Y inhibit signals prevent the recorder from moving during power up. The Y axis is enabled on the 2nd clock pulse and returns the pen to Y rest position. The X axis is enabled on the 4th clock pulse and returns the pen to the X rest position. Phase lock, XY return determines the recorder input during this initial period. Three clock pulses later Q3 of IC1A becomes a logic 1 resulting in logic at the output of IC3C thus defining the end of the phase lock, XY return interval. On the 7th clock pulse the output of IC3B goes to logic 1 for one clock cycle thus setting the pen-lift JK flipflop IC6A causing the pen to go down. On the 8th clock pulse the output of IC3A will become a logic thus ending the sweep clamp. At the end of the frequency sweep the Sweep Complete signal resets IC6A and IC1 and sets IC4A. IC6A will lift the pen and IC1 will repeat the initial sequence for returning the pen to the lower left rest position. Power Off will transition to logic 1 on the 7th clock turning off power. Shift

register IC1 is held reset when MAN or TRACK push buttons are pressed.

The Q output of IC6A controls a power amplifier that supplies current to activate the pen lift solenoid. In the Manual or Track modes, flipflop IC6A is enabled by holding the JK inputs at logic 1 using CR10 or CR11, respectively. Each positive going edge from pressing the PEN UP/DN momentary push button switch will change the Q output. The switch is coupled to the flipflop via transient filter R9, R10 and C3. In the Signature mode, diodes CR10 and CR11 are both reverse biased causing R8 to pull down the J and K inputs to logic 0. This inhibits the flipflop thus preventing the PEN UP/DN push button from changing the Q output. In the Signature mode the Set Input to the flip-flop activates the solenoid and drops the pen. A positive pulse occurring at the reset input will cause the pen to be lifted. The flipflop will be reset by power on reset or pushbutton action pulse or sweep complete.

3.6.2 VCO, Refresh, Track (Refer to Figure 3-3, 3-4 and 5-7)

The voltage controlled oscillator (VCO) consists of dc to frequency converter IC15 and associated circuitry including timing capacitor C26. R58, C25, L1 and R59, C27, L2 filter the power lines to IC15. IC15 output clocks IC6B which divides by two generating VCO ϕ1 and VCO ϕ2 inputs to the 1st modulator. In the 150 Hz frequency range VCO ϕ1 and VCO ϕ2 vary from 2000 to 2150 Hz. In the 1500 Hz range they vary from 2000 to 3500 Hz.

IC15 is controlled by an internal summing junction that sums the currents generated by the 2k Hz Adjust R53 and R54, IC10C and R49 and R50 and IC14 and R51. R53 and R54 provide a constant current that provides initial 2000 Hz calibration. IC's 14, 16A and 16B comprise the sample and hold portion of a phase locked loop referenced to 2k Hz Ref from the crystal controlled reference oscillator. IC's 17A and B comprise a phase detector that compares the 2k Hz Ref signal to VCO ϕ2. Loop closure is achieved when Phase Lock, XY Return or IC11B Q3 output are logic 1 causing the VCO to calibrate to 2k Hz. Phase Lock, XY Return controls the loop when Sig Start is pressed while Q3 controls when MAN, TRACK or other buttons are pressed. This calibration interval compensates for temperature changes and component aging.

During the calibration interval, switches IC16A and IC16B are closed allowing the integrator IC14 to average the pulse width modulated output from the phase detector and charge C24 to the proper correction voltage. The error voltage is fed back to the VCO through R51. R52 and C23 act as a lead network to stabilize the loop. At the end of the calibration interval switches 16A and 16B open causing the correction voltage to be stored in the integrating capacitor, C24.

When Enable VCO goes to logic 1, switch IC13A closes allowing VCO Control to determine the VCO output. IC10C scales, offsets and inverts VCO Control. During the calibration interval switch IC13A is open causing IC10C pin 8 to be the same as the .4V Ref at pin 10 defining 0 Hz on the card. The output of IC10C is held constant to ensure that the 2000 Hz phase lock occurs properly, independant of VCO Control. When the 150 Hz Frequency push button is pressed, switch IC13B is open allowing R42 and R43 to control the VCO output. When the 1500 Hz Frequency push button is depressed, switch IC13B is closed resulting in R45 and R46 controlling the VCO output.

The VCO is also calibrated when the MAN or TRACK push buttons are pressed or when frequency or velocity multiplier buttons are pressed after MAN or TRACK. The calibration timing is controlled by IC11 A & B, IC4C and IC4D. When the Model 2521 is turned on, the power on reset switches high for approximately 1.5 seconds and resets IC11A, IC11B and IC4 C & D. When SR flipflop (IC4D) is reset, the Q output Recorder Enable becomes logic 0 resulting in the recorder and track PLL being disabled. This minimizes spurious movement of the pen due to changes in the signal processing circuitry. When the reset switches low decade counter IC11A is able to count resulting in a 20 Hz pulse at pin 1 of decade counter IC11B. On the rising edge of the second clock pulse, RS flipflop IC4C Q output VCO Refresh is set to logic 1. VCO Refresh is used to generate Enable VCO that controls switch IC13A. On the 4th clock pulse Q3 of IC11B goes to logic 1 and remains for 4 clock counts (.2 sec.). The VCO is calibrated to 2 kHz during this period. On the 9th clock pulse IC4C is reset to logic 0 ending the VCO refresh period and causing VCO Control to determine the VCO output. Approximately 10 ms later Recorder Enable goes to logic 1 and enables the recorder. Pushbutton Action Pulse initiates this timing cycle by resetting IC4D thereby enabling IC11B.

In the Manual Tuning mode, VCO Control is determined by the manual tune potentiometer. The pot wiper voltage varies linearly from .22 to 3.2V with rotational angle. The pot wiper voltage is fed to unity gain buffer IC10A via low pass filter R36, C18. This filter reduces wiper contact noise and induced transients. The output from IC10A is summed with the tracking feed back voltage from integrator IC9 by IC10B. In the manual tuning mode the tracking feed back voltage is held to 0.0 volts by Q2 clamping integrator capacitor C17 and Q1 turning off switches IC8A and 8B.

The frequency tracking mode controls the VCO such that the input signal always remains at the center of the second IF filter. Center tuning is accomplished using a phase detector comprised of flipflops IC 7A and 7B to compare the 2nd IF filter output to a 200 Hz crystal controlled reference. The IF filter output is squared and applied to IC7A pin 3. The 200 Hz Reference is applied to IC7B pin 11. The phase detector is similiar in operation to the 2 kHz calibrate phase detector comprised of IC17A and 17B. The phase detector pulse width modulated output at the

junction of R22 and R23 is fed to integrator/sample and hold IC19 using switches IC8A and 8B. The integrator averages the phase detector output and sets the proper correction voltage across C17. IC8A and 8B are on when Exceeds 5% FS and Recorder Enable are logic 1. When either signal is logic 0 the switches are off. C12 and C13 are used to stabilize the tracking loop. In the low frequency range switch IC8C places C12 in parallel with C13. The added capacitance is needed because of decreased 2nd IF filter bandwidth and a change of scaling in the VCO. The output of the integrator is then summed with the tuning pot wiper voltage to generate Man Track Sum at IC10B pin 1.

3.6.3 Strobe Trigger Modulator, LP Filter (Refer to Figure 5-8)

A strobe trigger output is available at the front panel for making visual observations using a strobe. This output is generated by mixing a Phase Shifted 2 kHz ref and the VCO output. IC5B and associated circuitry filter the higher order harmonics of the 2 kHz square wave reference. IC5C inverts the output from IC5B. The outputs from IC5C and 5B go to switches IC16C and 16D which are controlled by VCO ϕ1 and ϕ2, respectively. The switches and summing amplifier IC5D comprise the strobe trigger modulator. The modulator output contains both sum and difference frequencies. The difference frequency is obtained by passing the modulator output through a six pole active low pass filter. The filter, IC's 18A, B and C, is a Butterworth design, -3dB, at 1200 Hz. The filter output is applied to squaring amplifier IC18D that produces a square wave at the difference frequency. The square wave drives transistor Q3 whose output is Str Trigger.

3.6.4 Reference Oscillator, Push Button Detector (Refer to Figure 5-9)

The Reference Oscillator is a 180 kHz crystal controlled oscillator consisting of IC23 and crystal Y1. The 180 kHz signal is divided by 5 using IC's 24A and 25A. The 36 kHz output clocks two dividers. One, consisting of IC's 24B and 25B, divides by 20 and provides 1800 Hz ϕ1 and ϕ2 to the 2nd modulator. The second divider, consisting of IC's 26A, 27A and 27B, divides by 18 to generate 2 kHz Ref. IC26B divides 2 kHz Ref by 10 to generate 200 Hz Ref. The rising edge of 200 Hz Ref resets IC's 24B and 25B to ensure constant phase coherency between the frequency tracking phase detector, the strobe drive circuit and the 2nd modulator.

The Push Button Detector produces a Push Button Active Pulse whenever the MAN, TRACK, CAL, FREQUENCY or VELOCITY MULTIPLIER push buttons are pressed. Each push button has an action detect circuit consisting of a D type filpflop, IC's 19 and 20, and an exclusive or gate, IC's 21 and 22. The outputs from the exclusive or gates want to be logic 0 therefore the two inputs should be same. By pressing a push button one input is changed thereby causing the gate output to become logic 1. This transition clocks the flipflops and the output of the flipflop whose

D input changed when the push button was pressed will change making the gate inputs the same. The diode or gate allows each gate output to clock the flipflops.

3.6.5 Sweep Sequences, XY Control Logic (Refer to Figure 5-10)

The operation of this circuitry depends on the operating mode selected. If the BROADBAND button is pressed first and then the SIG START button the circuitry will power up with switch IC13C on, switch IC13D off, gates IC33C and IC32D and switches IC36B and 36C enabled. IC13C applies the output of sweep generator IC28 to threshold detectors IC's 29A, B, C and D and Switch IC30B. The detector outputs transition low as 3, .4, .2 and .1V, respectively are exceeded. The input to switch IC30A is also 3V and the input to switch IC30C is also .4V. The outputs from IC's 30A, 30B and 30C are tied together and buffered by IC10D to become VCO Control. Gates IC31A, 31B, 32A and 33B decode the threshold detector output and control switches IC30A, B and C. IC30C will be turned off, IC30B will turned on until the sweep voltage is 3V and IC30A will turn on at 3V. X Axis Control is made by dividing down VCO Control.

Y Axis Control is made by connecting the outputs of switches IC36A, B, C and D. First IC36D is turned on until .1V is reached to record the FREQUENCY button pressed. IC36C turns on between .1 and .2V to record Amp FS Analog. IC36B turns on between .2 and .4V to input OV. IF Det is recorded when IC36A turns on between .4 and 3V. Gates IC32B, 31C and 31D control these switches. Q6 is used to pull both X and Y Axis Controls negative when Phase Lock, XY Ret goes to logic 1. Enable VCO is made using gates IC32D and 33D and switch IC30D as an inverter. Enable VCO will be inverse of IC29B output. Sweep complete transitions from logic 0 to logic 1 at 3V.

If the MAN or TRACK push buttons are pressed the circuitry will power up with switch IC13C off, IC13D on and gates IC32B, 32C and IC33A enabled. IC13D applies Man Track Sum to the threshold detectors. Switches IC30A, B and C will determine VCO Control such that if Man Track Sum is less than .4V, between .4 and 3V or greater than 3V then VCO Control will be .4V, Man Track Sum or 3V, respectively. Y axis Control is determined by IC36. Enable VCO will be the inverse of VCO Refresh. Sweep Complete will always be logic 0.

3.7 X-Y RECORDER BOARD CIRCUIT DESCRIPTIONS

The X-Y Recorder Board contains the following functions:

1. X-Y Recorder
2. Phase Shifter, Pen Lift Driver

3.7.1 X-Y Recorder (Refer to Figure 5-11)

Since both the X and Y Axis circuitry are essentially identical only the Y axis will be described. Y Axis Control is applied to variable gain amplifier IC1A. IC1B and 1C prevent the amplifier output from exceeding the voltage at IC1B pin 12 and going below the voltage at IC1C pin 10, respectively. Error amplifier IC2A sums the amplifier IC1A output, Y-Zero adjust R13 and the output of IC1D that buffers Y Axis Servo Potentiometer. The error amplifier drives a power amplifier comprised of IC2B, driver transistors Q1 and Q3 and power transistors Q2 and Q4. Up scale movement requires that the outputs from IC2A and 2B swing negative causing Q3 and Q4 to conduct. The amplifiers will swing positive causing Q1 and Q2 to conduct for down scale movement. Y axis Inhibit causes Q5 to conduct and holds Q1 and Q3 base near ground.

Transistors Q11 and Q12 are used to put a load across the batteries when BAT button is pressed.

3.7.2 Phase Shifter, Pen Lift Driver (Refer to Figure 5-12)

The 2 kHz Ref input is ac coupled to comparator IC4A generating a pulse approximately 6 ms wide at pin 7. Since IC4A is a comparator with open collector output stages, a negative pulse at pin 7 shorts C8. When the input goes positive the internal transistor opens and allows constant current source Q14 and Q13 to linearly charge C8. When the capacitor voltage exceeds the voltage at the inverting input of comparator IC4C, the output switches high. Therefore the output of IC4C is delayed linearly with increasing voltage at the inverting input. -5V at the inverting input corresponds to $\phi°$ phase shift while +2.5V corresponds to 360°. The current source consisting of Q14 and Q15, causes the voltage at Trigger Adjust to vary from +0 to +2.5V when an external 2KΩ pot is varied over its range. The level shifter IC4B converts the 0V to +2.5V range to 2.5 to -5V range control voltage for comparator IC4C. The rising edge of comparator IC4C feeds buffer transistor Q16 which in turn triggers IC4D, a 250 ms one-shot. The output of the one-shot is Phase Shifted 2 kHz Ref approximately a squarewave at 2 kHz.

The Pen lift driver consists of transistors Q17 and Q18. When Pen Lift Control goes to Logic 1 the transistors will conduct and Pen Lift Drive will approach +7.2V.

R84 and R85 combine with the Manual Tune Pot to form a voltage divider that determines the pot wiper voltage.

3.8 PANEL BOARD CIRCUIT DESCRIPTIONS (Refer to Figure 5-13)

The panel board consists of push button switches and battery changing indicators. CAL, PEN UP/DN, SIG START and BAT are momentary switches. FREQUENCY and VELOCITY MULTIPLIER are interlocked switches. BROADBAND, TRACK, MAN and OFF are also interlocked.

3.9 POWER SUPPLY BOARD CIRCUIT DESCRIPTION (Refer to Figure 5-14)

T1 transforms down the line voltage and supplies voltage to full-wave rectifier diodes CR1 - CR4. C1 and C2 filter the plus and minus dc power supply ripple. Relay K1 determines the dc unregulated power source, either batteries or dc power supply. When the line cord is connected to ac power the dc power supply is selected otherwise battery power is selected.

Whenever connected to ac power, the batteries are charged by the dc power supply through two 15Ω resistors, R2 and R3 for the positive supply, and R8 & R9 for the negative supply. Transistors Q1 and Q2 monitor the voltage across these charging resistors and turn on the plus and minus charge indicators to verify battery charging.

S1 is used to set the operating voltage to 115 or 230 VAC. R6 is the load resistor when checking the battery charge status.

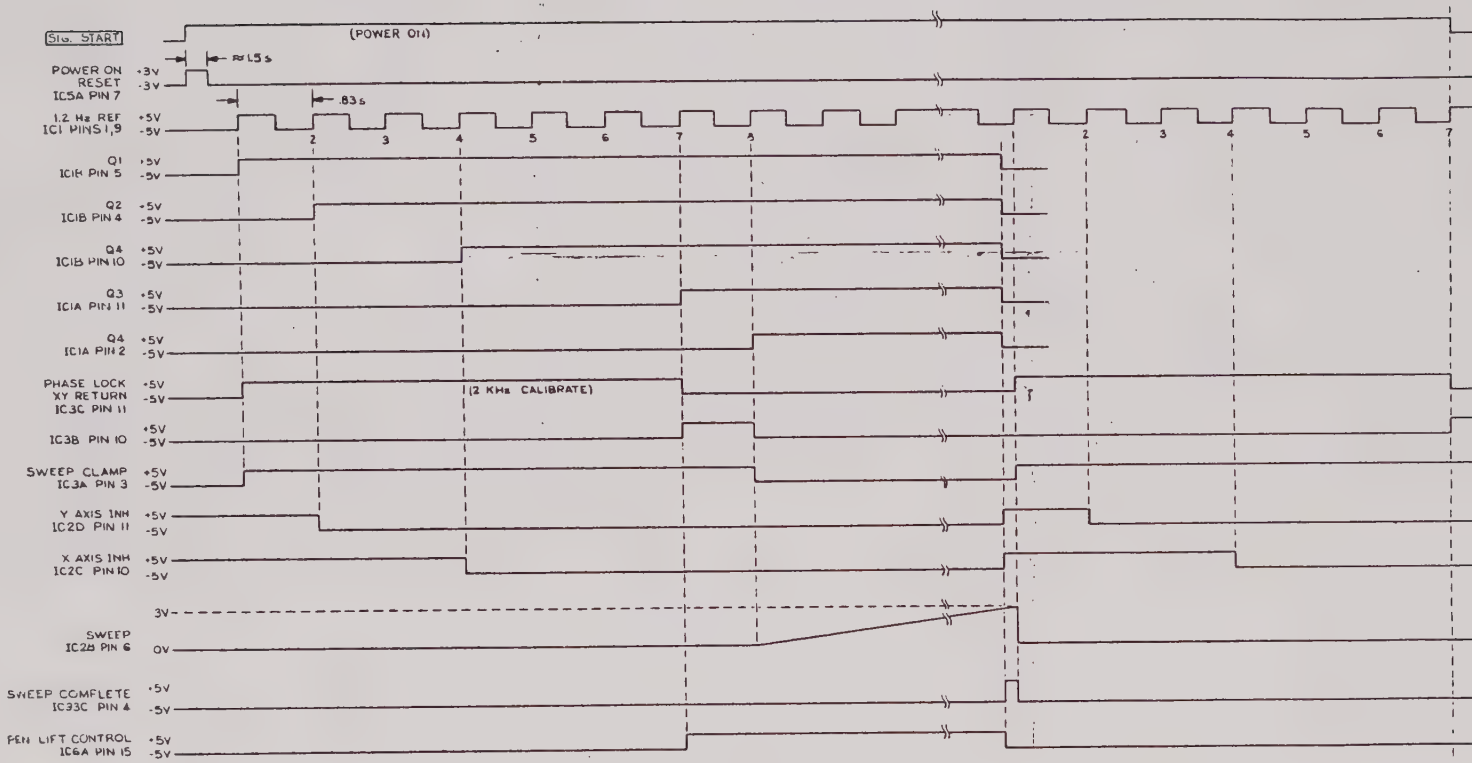


FIGURE 3-3
TIMING - AUTOMATIC VIBRATION
SIGNATURE MODE
MODEL 2521

	INPUT		MODEL 2521 CONTROLS		EXPECTED READING	
PARAGRAPH NO.	AMPLITUDE (mVrms)	FREQUENCY (Hz)	VEL MULT	FREQUENCY (Hz)	AMPLITUDE (ips pk)	FREQUENCY (Hz)
4.2.3 (Velocity Meter Test)	23 ±.5	1000 ±1	.2	- - -	.2	- - -
	115 ± 2	1000 ±1	1.0	- - -	1.0	- - -
	575 ±10	1000 ±1	5.0	- - -	5.0	- - -
4.2.4 (Spectral Velocity/ Frequency Test)	14.7 ±.2	30 ±1	5.0	150	4.25 ±.25	30 ± 4
	39.1 ±.4	80 ±1	5.0	150	4.25 ±.25	80 ± 6
	63.6 ±.7	130 ±1	5.0	150	4.25 ±.25	130 ± 7
	29.3 ±.3	300 ±3	1.0	1500	.85 ±.05	300 ±40
	78.2 ±.8	800 ±3	1.0	1500	.85 ±.05	800 ±60
	127.1 ±1.3	1300 ±3	1.0	1500	.85 ±.05	1300 ±70
	5.9 ±.1	300 ±3	0.2	1500	.17 ±.01	300 ±40
	15.65 ±.2	800 ±3	0.2	1500	.17 ±.01	800 ±60
	25.42 ±.3	1300 ±3	0.2	1500	.17 ±.01	1300 ±70
4.2.5 (Internal Calibrator Test)	- - -	- - -	1.0	150	.80 ±.04	20 ±3.6
	- - -	- - -	1.0	1500	.80 ±.04	200 ±36
4.2.6 (Acceler-ometer Test)	- - -	- - -	1.0	150	.85 ±.15	100 ±8

PERFORMANCE TEST CHART

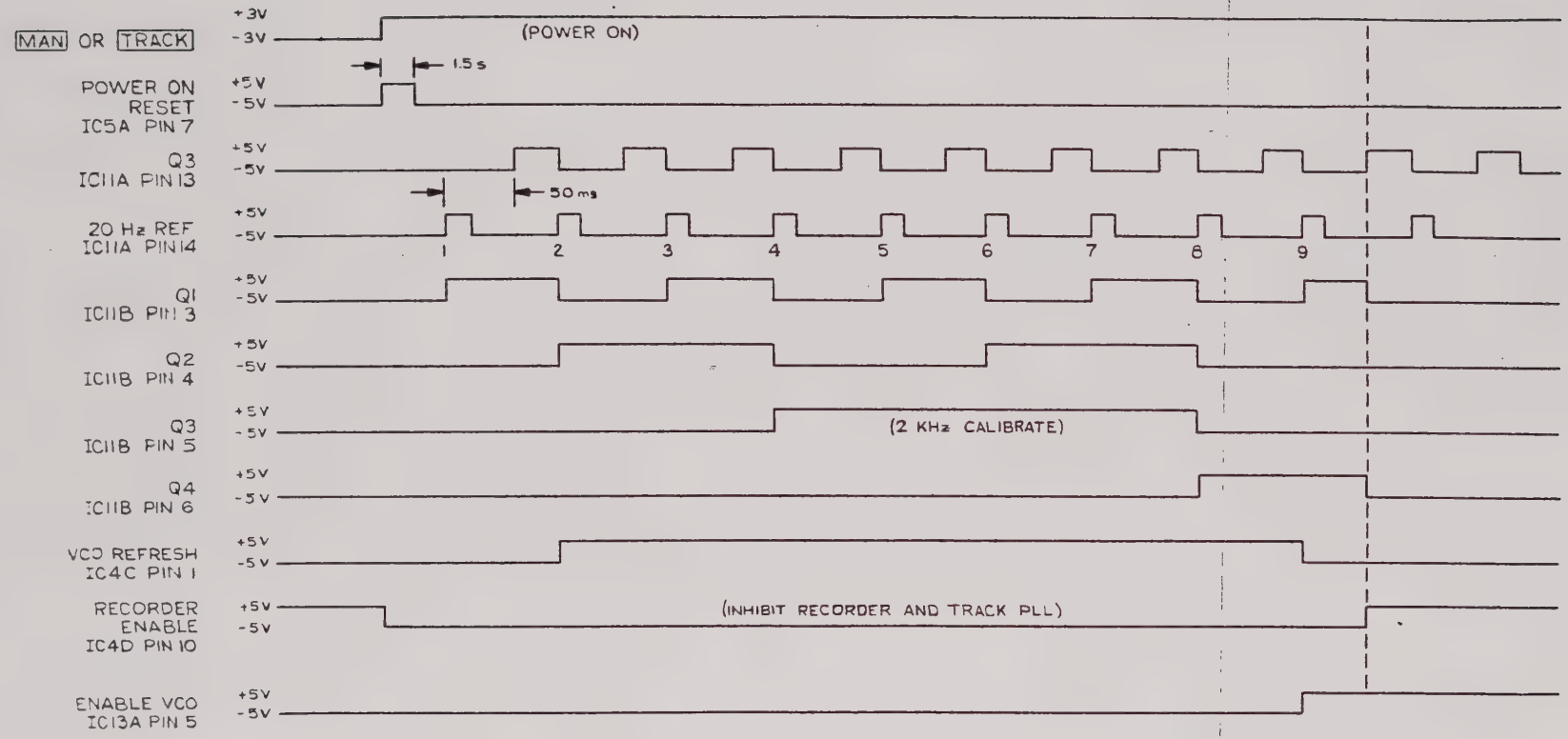


FIGURE 3-4
TIMING, MANUAL TUNING AND
FREQUENCY TRACKING MODES
MODEL 2521

SECTION 4

Maintenance and Calibration

4.1 INTRODUCTION

This section contains information needed to verify specifications, calibrate and maintain the Recorder. Included are procedures for both mechanical and electrical calibration, minor repairs and trouble-shooting.

4.2 PERFORMANCE VERIFICATION

4.2.1 Test Equipment Required

1) Digital Multimeter - HP3644A or equal
2) Signal Generator
3) Frequency Counter
4) Vibration Calibrator - Gen Rad 1557A or equal
5) Recorder cards - 2521-1

4.2.2 Procedure

Each of the following paragraphs describes a test which verifies an electrical specification of the Recorder. The setting of input parameters and Recorder controls for each test is outlined in the Performance Test Chart, Table 4-1.

4.2.3 Velocity Meter Accuracy

The purpose of this test is to verify the accuracy of the VELOCITY meter. Connect the output of the signal generator to the Recorder INPUT. Set the generator output frequency to 1000 Hz and monitor the amplitude with the multimeter. Press the BROADBAND pushbutton. Set the Recorder controls as indicated on the chart and record the input amplitude required for VELOCITY meter FS indication.

4.2.4 Spectral Velocity and Frequency Accuracy

The purpose of this test is to verify the accuracy of velocity and frequency measurements recorded on the vibration signature cards. Connect the output of the signal generator to the Recorder INPUT. Set the input amplitude and frequency and the Recorder controls as indicated on the chart. Insert 2521-1 card and pen. Press the MAN pushbutton and manually tune to the input. Press the Track pushbutton. Press the PEN UP/DN pushbutton twice leaving a mark on the card. Read the velocity and frequency at the

mark and compare to expected readings. Change pen color whenever the VELOCITY MULTIPLIER is changed.

4.2.5 Internal Calibrator

The purpose of this test is to verify the internal calibrator is functioning properly. Install a 2521-1 card and pen. Set Recorder controls as indicated in table. Press the BROADBAND pushbutton. Press the CAL pushbutton and hold pressed. Press the SIG START pushbutton and observe recording being made. Read the amplitude and frequency of the first peak and compare to expected readings.

4.2.6 Accelerometer

The purpose of this test is to verify the accelerometer is functioning properly. Install a 2521-1 card and pen. Set Recorder controls as indicated in table. Mount the 9952 accelerometer supplied with the Recorder to the vibration calibration. Connect the accelerometer to the Recorder using the 9194 cable supplied. Press BROADBAND pushbutton. Press SIG START pushbutton. Read the peak velocity and frequency and compare to expected readings.

4.3 PREPARATION FOR CALIBRATION

4.3.1 Test Equipment Required

1) Digital Multimeter - HP3466A or equal
2) Signal Generator - HP3325A or equal
3) Frequency Counter - Data Precision 5740 or equal
4) Recorder Cards - 2521-1
5) Bnc Terminations - 50, 75 or 1500 Ω
6) Oscilloscope - Tektronix 465 or equal
7) Resistors 194 ±1 Ω and 1746 ±1 Ω

4.3.2 Removal from Case

Before removing the Recorder from the case, press the OFF pushbutton and disconnect the line cord from ac power. Remove the four screws holding the Recorder located at the corners of the front panel. They are the largest of the front panel screw heads. Carefully lift the Recorder vertically out of the case until the ribbon cable is all that connects the panel to the case. Place the Recorder panel face down on a soft surface to avoid scratches. In the event that cabling procedures are necessary, disconnect the ribbon cable from the power supply board. The retainer clips must be spread apart to extract the ribbon cable connectors.

4.3.3 Identification

Each PW board has a descriptive name and assembly number that can be found on the schematic diagram in Section 5. The assembly

Table 4-1. Troubleshooting Chart

SYMPTON	PROBABLE CAUSE	REMEDY
1. Unit fails to operate in any mode, AC or DC	a) Power supply cable loose	a) Check power supply cable
	b) Line fuse bad	b) Check line fuse and replace if necessary
	c) Power-up circuit malfunction	c) Check power-up circuit (Refer to section 3.5.1)
2. Unit operates on AC power only	a) Battery condition very low	a) Check battery condition and charge for 14-16 hours
	b) Battery fuses bad	b) Check battery fuses and replace
	c) Defective power supply relay	c) Check power supply circuit (Refer to section 3.9)
3. Broadband meter does not indicate	a) Defective accelerometer or cable	a) Check and replace if necessary
	b) Input signal conditioning malfunction	b) Conditioning circuits and broadband detector (Refer to sections 3.5.1 and 3.5.2)
4. Pen does not move in X direction	a) X-axis cable broken	a) Inspect and replace cable (Refer to section 4.5)
	b) X-axis drive circuit defective	b) Check X-axis drive circuit (Refer to section 3.7)
	c) Malfunction in X-Y control logic	c) Check X-Y control logic (Refer to section 3.6)
5. Pen does not move in Y direction at any time	Same as above for Y-axis	Same as above for Y-axis
6. Pen does not move in Y direction during frequency sweep or in manual mode	a) VCO malfunction	a) Check VCO circuit (Refer to section 3.6.2)
	b) Input signal conditioning malfunction	b) Check input signal conditioning circuits (Refer to section 3.5.1)
	c) First modulator malfunction	c) Check first modulator circuit (Refer to section 3.5.2)
	d) First IF filter/second modulator malfunction	d) Check first IF/second modulator circuits (Refer to figure 3.5.3)
	e) Second IF filter/IF detector malfunction	e) Check second IF/IF detector circuits (Refer to section 3.5.4)
7. Unit will not plot internal calibrator signal	a) Calibrator circuit malfunction	a) Check calibrate circuit (Refer to section 3.5.2)
8. Erratic X or Y-axis movement	a) Low battery condition	a) Check battery condition and charge 14-16 hours if necessary
	b) Defective servo pot	b) Inspect appropriate pot - replace if necessary
9. Unit will not track a signal	a) Insufficient signal level	a) Use more sensitive amplitude range
	b) Input signal exceeds maximum tracking rate	b) Use high frequency range for faster tracking rate (Refer to section 2.3.4)
	c) Tracking circuitry malfunction	c) Check tracking circuitry (Refer to section 3.6.2)
10. Batteries will not charge	a) Line fuse bad	a) Check line fuse and replace if necessary
	b) Battery fuses bad	b) Check battery fuses and replace if necessary
	c) Charging circuit malfunction	c) Check charging circuit (Refer to section 3.9)
11. Batteries will not hold a charge	a) One or more defective cells	a) Check cells and replace as necessary
12. Unit will not turn off when "OFF" button is pressed	a) Malfunction in power-up circuit	a) Check power-up circuit (Refer to section 3.5.1.)

number is also stamped on the component side of the PW board. Test points and adjustments are called out by a descriptive name in the calibration procedure.

4.4 CALIBRATION PROCEDURE (Refer to Figure 4-1)

Perform each step of the procedure in the order presented. All signals are measured with respect to GROUND (TP3, 10263).

4.4.1 Set Up Inhibits

1) Short the input connector with a short clip lead or a standard 50 or 75 ohm BNC termination.

2) Connect a jumper from MOTOR DRIVE INHIBIT (TP3, 10267) to +5V2 (TP1, 10263).

4.4.2 Power Supplies

1) Press the MAN pushbutton.

2) Adjust -5V (R33, 10263) for -5V ±4 mV at -5V2 (TP2, 10263).

3) Adjust +5V (R36, 10263) for +5V ±4 mV at +5V2, (TP1, 10263).

4.4.3 1st IF Filter

1) Connect a jumper from 2 kHz REF (TP1, 10265) to 1st IF Input (TP4, 10263). Rotate the manual tune control fully clockwise.

2) Monitor the 2 kHz signal at 1st IF OUT (TP7, 10263) with the oscilloscope.

3) Adjust alternately FREQ (R67, R74 and R81, 10263) for maximum amplitude, approximately 170 mV p-p.

4) Remove the connection made in Step 1.

4.4.2 2nd IF Filter

1) Connect a jumper from 200 Hz REF (TP6, 10263) to 2nd IF INPUT (TP9, 10263).

2) Press the 150 Hz Frequency pushbutton.

3) Monitor the 200 Hz signal at 2nd IF OUT (TP10, 10263) with the oscilloscope.

4) Adjust alternately FREQ (R95, 104, 113, 10263) for a maximum amplitude, approximately 1.25 V p-p.

5) Remove the connection made in Step 1.

4.4.5 Voltage Controlled Oscillator (Refer to Figure 5-7)

1) Connect a 1000 ohm resistor across capacitor C24. Rotate the manual tune control fully counter clockwise. Verify that the voltage at IC14 pin 6 is less than 0.1V.

2) Monitor VCO ϕ1 (TP5, 10263) with the frequency counter.

3) Adjust 2000 Hz (R53, 10265) for 2000 ± 1 Hz.

4) Rotate the manual tune control fully clockwise. Adjust 2150 Hz (R43, 10265) for 2150 ±3 Hz.

5) Press the 1500 Hz Frequency pushbutton.

6) Adjust 3500 Hz (R46, 10265) for 3500 ±20 Hz.

7) Remove the 1000 ohm resistor added in Step 1.

4.4.6 System Gain

1) Press the 0.2 VELOCITY MULTIPLIER pushbutton.

2) Monitor IF DET OUT (TP11, 10263) with a digital voltmeter. Adjust 150 and 1500 Hz GAIN (R130 and R131, 10263) full clockwise. Adjust DET ZERO (R122, 10263) for 0 ±2 mVdc.

3) Adjust METER ZERO (R38, 10263) for a VELOCITY meter indication of zero.

4) Press the OFF pushbutton and wait for the off sequence to finish. Remove the jumper from MOTOR DRIVE INHIBIT (TP3, 10267).

5) Remove the short from the INPUT connector and connect the signal generator to the INPUT. Set the generator output to 115.0 ±1 mV rms at 1000 ±1 Hz.

6) Press the MAN and 1.0 VELOCITY MULTIPLIER pushbuttons.

7) Adjust the manual tune control until the recorder Y axis is peaked and press the TRACK pushbutton.

8) Monitor IF DET OUT (TP11, 10263) with a digital voltmeter and adjust 1500 Hz GAIN (R130, 10263) for 1.00 ±.02V dc.

9) Press the 150 Hz FREQUENCY pushbutton.

10) Set the generator output to 11.5 ±.1 mV rms at 100 ±1 Hz.

11) Press the MAN pushbutton and tune the recorder until the Y axis peaks.

12) Press the TRACK pushbutton.

13) Adjust 150 Hz GAIN (R131, 10263) for 1.00 V ±.01 Vdc.

14) Adjust METER FS (R48, 10263) until the VELOCITY meter reads full scale.

15) Disconnect the signal generator and replace with short or BNC termination.

4.4.7 X-Y Recorder

1) Insert a 2521-1 recorder card and pen. Turn Y LIMIT and X LIMIT (R4 and R35, 10267) full clockwise.

2) Press the MAN pushbutton.

3) Rotate the MAN tune control fully clockwise.

4) Adjust X GAIN (R38, 10267) until the pen sits on the full scale frequency grid line.

5) Rotate the MAN tune control fully counter-clockwise.

6) Adjust X ZERO (R44, 10267) until the pen sits on the zero frequency grid line.

7) Repeat step 4, 5, 6 and 7 until the pen sits on the full scale or zero grid lines when the MAN tune control is rotated fully CW or CCW, respectively.

8) Rotate the MAN tune control fully clockwise.

9) Adjust X GAIN (R38, 10267) until the pen moves 1/16 inch to the right of the grid area.

10) Rotate X LIMIT (R35, 10267) counterclockwise until the pen begins to move.

11) Adjust X GAIN (R38, 10267) until the pen sits on the full scale frequency grid line.

12) Press the 1.0 VELOCITY MULTIPLIER and 1500 Hz FREQUENCY pushbuttons.

13) Adjust Y ZERO (R13, 10267) until the pen sits on the zero velocity grid line.

14) Remove the termination from the INPUT connector and connect the signal generator to the INPUT. Set the generator output to 115 ±1 mV rms, 1 kHz sine wave.

15) Adjust the MAN tune control and tune to the input. Press TRACK pushbutton.

16) Adjust Y GAIN (R7, 10267) until the pen sits on the full scale velocity grid line.

17) Replace INPUT short and repeat steps 13, 14, 15 and 16 until the pen sits on the zero or full scale velocity grid lines with a short or a 115 ±1 mV rms, 1000 ±1 Hz at the input.

18) Connect the generator to the INPUT connector. Tune to and track a 1000 Hz signal. Adjust the amplitude to approximately 125 mV rms.

19) Rotate Y LIMIT (R4, 10267) counterclockwise until the pen sits 1/16 inch above the full scale velocity grid line.

4.4.8 Frequency Calibration

1) Insert a 2521-1 signature card and pen. Press the MAN pushbutton.

2) Press the 150 Hz FREQUENCY pushbutton and tune to 140 Hz.

3) Press the 1.0 VELOCITY MULTIPLIER pushbutton.

4) Connect the signal generator to the INPUT connector. Set the generator output to 10 ±1 mV rms at 140 ±1 Hz.

5) Press the TRACK pushbutton.

6) Press the PEN UP/DN pushbutton.

7) Adjust 2150 Hz (R43, 10265) until the pen sits on the 140 Hz card line.

8) Press the PEN UP/DN and MAN pushbuttons.

9) Press the 1500 Hz FREQUENCY pushbutton and tune to 1400 Hz.

10) Set the generator output to 100 ±10 mV rms at 1400 ±1 Hz.

11) Press the TRACK and PEN UP/DN pushbuttons.

12) Adjust 3500 Hz (R46, 10265) until the pen sits on the 1400 Hz card line.

13) Press the MAN pushbutton.

4.4.9 Phase Shifter

1) Press the 150 Hz FREQUENCY and the 5 ips VELOCITY MULTIPLIER pushbuttons.

2) Set the generator output to 64 ±5 mV peak to peak square wave at 50 ±2 Hz.

3) Monitor the generator output and the STR TRIGGER (BLACK, J5) on a dual trace scope. Sync the scope with the generator output positive edge. Adjust the scope sweep for 1 ms/cm.

4) Press the MAN pushbutton and tune to 50 Hz.

5) Press the TRACK pushbutton.

6) Connect a 1746 Ω resistor from STR ADJUST (RED, J5) to ground at J5.

7) Note the position of the STR TRIGGER falling edge.

8) Replace the 1746 Ω with 194 Ω ±1 Ω. Again note the position of the falling edge.

9) Adjust PHASE FS (R64, 10267) until the time between the rising edges noted is 4.0 ±.3 ms. Turning R64 CW will increase the time while turning CCW will decrease the time.

4.5 RECORDER CABLING PROCEDURES

4.5.1 Test Equipment Required

Digital Multimeter - HP3466A or equal.
Spring Scale, 36 oz. range in ½ oz. increments - Chatillon or equal.

4.5.2 Y-Axis Cabling (Refer to Figures 4-2 and 5-15)

1) Remove the Recorder from the case as per paragraph 4.3.2 and disconnect P15 from assembly 10269.

2) Refer to Figure 5-15 and remove the two cable covers, symbol 9. There's one #4 screw at each end of a cover.

3) Remove the four screws and two nuts securing the Analyzer Board and carefully fold the board out of the way.

4) Rotate the Y-Axis variable resistor shaft slowly in a clockwise direction until its end stops prevent further rotation. The variable resistor shaft can be easily turned by rotating its attached gear assembly, symbol 12 in Figure 5-15. The cable retaining holes in the groove of the pulley should be directed toward the panel. Refer to Figure 4-2b.

5) Check to be certain that the body of variable resistor, symbol 34 of Figure 5-15, cannot rotate. If it is loose, anchor it by tightening its retaining nut located between the gear and the bracket. Once this is secured, loosen the two set-screws, symbol 39, holding the gear assembly to the variable resistor shaft. Rotate the gear assembly in a clockwise direction until the cable retaining holes in the groove of the pulley are directed toward the panel. Tighten the two set-screws in the pulley hub.

6) Draw a pencil mark on the large gear at a point opposite the panel and the cable retaining holes as indicated in Figure 4-2b. Carefully rotate the large gear 2½ turns counterclockwise. The pencil mark should now be adjacent to the panel and the midpoint

between the cable retaining holes should face away from the panel as indicated in Figure 4.2f. Install the temporary Locking Clip as indicated in Figure 4.2f. The outer wire loop of a 1 3/4" long paper clip will do nicely. CAUTION should be exercised when using this clip as any excessive tension in the cable or trying to force the gears against the clip may damage the gear teeth.

7) Measure 70 inches of cable and thread it through the retaining holes in accordance with Figure 4-2c. Adjust the cable lengths so that end N is 10 inches longer than end M. Tie a small loop at the end of N.

8) Use a rubber band to retain the pen holder against a 1 7/8" spacer in accordance with Figure 4-2f. A length of pencil with electrical tape on the ends will do for the spacer.

9) Wind cable end M, 3 turns counterclockwise to the gear side of the retaining holes, keeping the turns nested tightly together. Refer to Figure 4-2d. Route this end of the cable around the Y-Axis pulleys in accordance with Figure 4-2f. String the cable between the anchor clip and the Y-Axis anchor bracket, symbol 6 , of Figure 5-15. Take the slack out of the cable and clamp the cable end in place by tightening the screw.

10) Returning to the bottom at the panel, wind 3 closely nested turns clockwise around the pulley with the remaining length of cable as shown in Figure 4-2e. Route this end of the cable, N, around the remaining Y-Axis pulleys in accordance with Figure 4-2f. Anchor the cable with the remaining anchor clip by tightening the screw.

11) Remove the rubberband, spacer and the temporary locking clip from the gears.

12) Refer to Figure 4-2f, to adjust the cable tension. Position the spring scale as indicated in line with the cable. While maintaining tension on the cable loop with the spring scale, loosen the clamping screw on the anchor clip until the cable slides freely. Increase the tension of the spring scale until a reading of 21 ±½ oz. is obtained. Retighten the clamping screw. Trim off the excess cable leaving a 3/8 inch length at each end.

13) Reposition the Analyzer Board and secure it with the hardware removed in paragraph 4.5.2.3.

14) Replace the two cable covers with the hardware removed in paragraph 4.5.2.2.

4.5.3 X-Axis Cabling (Refer to Figures 4-3 and 5-15)

1) Remove the Recorder from the case as per paragraph 4.3.2 and

disconnect P15 from assembly 10269.

2) Refer to Figure 5-15 and remove the two cable covers, symbol 9. There's one #4 screw at each end of a cover.

3) Remove the four screws and two nuts securing the Analyzer Board and carefully fold the board out of the way.

4) Rotate the X-Axis variable resistor shaft slowly in a clockwise direction until its end stops prevent further rotation. The variable resistor shaft can be easily turned by rotating its attached gear assembly, symbol 11 in Figure 5-15. The cable retaining holes in the groove of the pulley should be directed away from the panel. Refer to Figure 4-3b.

5) Check to be certain that the body of variable resistor, symbol 34 of Figure 5-15, cannot rotate. If it is loose, anchor it by tightening its retaining nut located between the gear and the bracket. Once this is secured, loosen the two set-screws holding the gear assembly, symbol 39, to the variable resistor shaft. Rotate the gear assembly in a clockwise direction until the cable retaining holes in the groove of the pulley are directed away from the panel. Tighten the two set-screws in the pulley hub.

6) Draw a pencil mark on the large gear at a point opposite the panel as indicated in Figure 4-3b. Carefully rotate the large gear 2½ turns counterclockwise. The pencil mark should now be adjacent to the panel as should the midpoint between the cable retaining holes as indicated in Figure 4-3f. Install the temporary Locking Clip as indicated in Figure 4-3f. The outer wire loop of a 1 3/4" long paper clip will do nicely. CAUTION should be exercised when using this clip as any excessive tension in the cable or trying to force the gears against the clip may damage the gear teeth.

7) Referring to Figure 4-3c, thread a 70 inch length of cable through the retaining holes. Adjust cable end M to a length of 25 inches and tie a small loop at its end.

8) Use a rubberband to retain the X-Axis Bracket against a 2 7/8" spacer in accordance with Figure 4-3f. A length of pencil with electrical tape on the ends will do for the spacer.

9) Referring to Figure 4-3d, wind length N, 3 turns clockwise to the side away from the gear keeping the turns nested tightly together. Route this end of the cable around the X-Axis pulleys in accordance with Figure 4-3f. See cross-over caution in Figure 4-3f. String the cable through the anchor clip at "B". Take the slack out of the cable and clamp the cable end in place by tightening the screw.

10) Wind 3 turns counterclockwise to the gear side of the retaining holes keeping the turns nested tightly together. Route this

end of the cable, end M, Figure 4-3e, around the remaining X-Axis pulley (Figure 4-3f) through the remaining clip at "A". Take the slack out of the cable and clamp it in place by tightening the anchor screw.

11) Remove the rubberband, spacer and the temporary locking clip from the gears.

12) Refer to Figure 4-3f to adjust the cable tension. Position the spring scale as indicated, in line with the cable. While maintaining tension on the cable loop with the spring scale, loosen the clamping screw on the anchor clip at "A" until the cable slides freely. Increase the tension on the spring scale until a reading of 31 ±½ oz. is obtained. Retighten the clamping screw. Trim off the excess cable leaving a 3/8" length at each end.

13) Slide the carriage slowly to the Motor/Pot Mounting Bracket, Figure 5-15 symbol 2 . The X-Axis Brackets at each end of the Y-Axis rods should be positioned as closely as possible to the Motor/Pot Mounting Bracket. Tighten the Anchor Clips at "C" to clamp the cable.

14) Reposition the Analyzer Board and secure it with the hardware removed in paragraph 4.5.3.3.

15) Replace the two cable covers with the hardware removed in paragraph 4.5.3.2.

4.5.4 Recorder Cabling Checks (Refer to Figures 4-1, 4-2, 4-3 and 4-4)

After the cabling procedure in paragraphs 4.5.2 and 3 are completed, the following checks must be made to determine if the servo positioning variable resistors, R1 (Y-Axis) and R2 (X-Axis) are positioned correctly and that the cable has been wound correctly on the gear pulleys.

1) To check tension in the Y-Axis cable, turn the panel face up and slide the pen holder to the position shown in Figure 4.4a. Use a spring scale to pull at a right angle to the cable at the location indicated in Figure 4-4a. Pull on the cable until it just touches the Y-Axis Guide. The scale should indicate 4 ±½ oz. If the reading is beyond this range, loosen one of the clamping screws on a Y-Axis Anchor Clip, Figure 4-2f, and adjust the cable tension to the proper value. Tighten the clamping screw.

2) To check the tension in the X-Axis cable, refer to Figure 4-4b. Place the panel face down on cushioning material and slide the X-Axis bracket to the stop indicated in Figure 4-4b. Using a spring scale, pull at a right angle to the cable at the location indicated in Figure 4-4b. The displacement should be ¼" when the reading is taken. The scale should indicate 6 ±½ oz. If the reading is beyond this range, loosen one of the clamping screws at "A" or "B", Figure 4-3f, and adjust the

cable tension to the proper value. Tighten the clamping screw.

3) Reconnect P15 to assembly 10269.

4) Connect a jumper from MOTOR DRIVE INHIBIT (TP3, 10267) to +5V2 (TP1, 10263).

5) Insert a blank card and a pen.

6) Press the MAN pushbutton and carefully move the pen carriage so that the pen tip rests at the lower left printed corner of the card.

7) Measure the voltage at Y-POSITION (TP2, 10267) and X-POSITION (TP5, 10267) with a DVM. If the recorder was properly cabled, these test points should read 1V ±150 mV dc.

8) Press the OFF pushbutton.

9) Remove the connection from MOTOR DRIVE INHIBIT (TP3, 10267) to +5V2 (TP1, 10263) and refer to Section 4.4.7 for calibration of the recorder circuit board.

4.6 MINOR REPAIR PROCEDURES

4.6.1 Battery Replacement (Refer to Figure 5-14)

1) Disconnect line cord from ac power.

2) Remove the Recorder from the case. Refer to Section 4.3.2.

3) Disconnect P15 from assembly 10269.

4) The plastic container on assembly 10269 contains the batteries (BT1 and BT2).

5) Remove the four screws visible on the top of the battery pack and carefully remove the hardware from the case.

CAUTION

Keep conductive material away from the fuse clips and the batteries. A short circuit in this area can discharge the battery pack energy. There is sufficient energy in the battery pack to generate sparks, cause burns and fuse tools.

6) There are 12 separate cells inside the battery pack. Replace the cells making certain that the cells are in series in accordance with the indicators on the bottom of the battery pack and Figure 5-14.

7) Make certain that all of the spring contacts are making proper connections.

8) Inspect for and remove any debris that may have fallen into the battery pack.

9) Reposition the battery pack cover and secure it with the hardware removed in Step 5. Note that the lock washer must be sandwiched between the head of the screw and the flat washer.

10) Carefully tilt the case to its rear after securing the accessory compartment door and removing the loose cards and pens. Remove any debris that can be seen.

11) Connect P15 to assembly 10269.

12) Carefully replace the panel assembly in the case and secure it with the hardware removed in Section 4.3.2.

4.6.2 Discrete Component Replacement on PC Boards

1) Disconnect all power to the equipment.

2) Remove the panel assembly from the case. Refer to Section 4.3.2.

3) Locate the defective component.

4.6.3 COS/MOS IC Replacement and Handling

1) When removing COS/MOS IC's , remove the solder around each lead and gently nudge each lead until it is free from any foil contact.

2) Remove the IC from the board and replace ONLY with the same type.

The following information is presented to acquaint those unfamiliar with the handling of COS/MOS IC's.

3) The input protection networks incorporated in most COS/MOS devices are effective in a wide variety of device handling situations. To be totally safe, however, it is desireable to restate the general conditions for eliminating all possibilities of device damage. Since COS/MOS devices have extremely high input resistance, they are susceptible to damage when exposed to extremely high static electrical charges. To avoid possible damage to the devices during handling, testing, or actual operation the following procedures should be followed:

a) The leads of devices should be in contact with a conductive material, except when being tested or in actual operation, to avoid build-up of static charge.

b) Soldering-iron tips, metal parts of fixtures and tools, and handling facilities should be grounded.

c) Devices should not be inserted into or removed from circuits with the power on because transient voltages may cause permanent damage.

d) Signals should not be applied to the inputs while the device power supply is off.

e) All unused input leads must be connected to either V_{SS} (ground) or V_{DD} (supply voltage), whichever is appropriate for the logic circuit involved.

4.6.4 Handling of Subassembly Boards

After COS/MOS IC's have been mounted on circuit boards, proper handling precautions should still be observed. Until these subassemblies are inserted into a complete system in which the proper voltages are applied, the board is no more than an extension of the leads of the device mounted on the board.

It is good practice during processing operations to put conductive clips or conductive tape on the circuit board terminals. The precaution prevents static charges from being transmitted through the board wiring to the devices mounted on the board.

All normal flux removing and degreasing solvents can be used without adversely affecting the reliability of COS/MOS plastic devices.

4.6.5 Soldering Time and Temperature

All device leads can withstand exposure to temperature as high as 265°C for 10 sec, MAX. and as close as 1/16 ±1/32 inch from the body of the device.

4.6.6 Storing of Printed Circuit Boards

Excessive humidity (greater than 60%) should be avoided during circuit board check out to prevent the false impression of excessive device internal leakage. High relative humidity may cause leakage paths between closely spaced elements of the circuit boards, such as the terminals and insulated metallized connection strips. Normally this added leakage is not significant in non-COS/MOS devices. However, when the nanoampere-leakage advantages of COS/MOS devices are desired, leakage currents on circuit boards or non-hermetic modules which are affected by high humidity become a major concern and must be controlled by coating, cleaning or better environmental controls.

4.7 TROUBLESHOOTING

4.7.1 Logical Troubleshooting

1) Symptom Recognition: This is the first step in the trouble-shooting procedures and is based on a complete knowledge and understanding of the equipment operating characteristics. Because visual indicators are an integral part of the circuitry, the trouble is frequently apparent from the presentation. All equipment troubles are not the direct result of a component failure and are not always easy to recognize, since all conditions of less than peak performance are not always apparent. Degradation in equipment performance is usually detected during preventive maintenance procedures. It is important that the "not so apparent" troubles as well as the apparent troubles be recognized.

2) Symptom Elaboration: After an equipment trouble has been "recognized" all available built-in trouble-shooting aids should be utilized to elaborate on the original trouble symptom. Use of front panel controls and built-in data indicator presentations may provide better identification of the original trouble symptom. For example, a faulty plotting symptom may be elaborated upon by changing the FREQUENCY to see if it is dependent upon switch settings. Frequently narrowing down the probable trouble area results with this technique. Also, checking or otherwise exercising the front panel controls may reveal that incorrect settings exist which have been overlooked.

3) Listing Probable Faulty Function: The next step in logical troubleshooting is to formulate a number of "logical choices" as to the cause and likely location (functional section) of the trouble. The "logical choices" are mental decisions which are based on a knowledge of the equipment operation, a full identification of the trouble symptom, and information contained in this manual. The overall functional description and its associated block diagram should be referred to when selecting possible faulty functional sections.

4) Localizing the Faulty Function: For the greatest efficiency in localizing trouble, the functional sections which have been selected by the logical choice method should be tested in an order that will require the least time. This requires a mental selection to determine which section to test first. The selection should be based on the validity of the logical choice and the difficulties in making the necessary tests. If the tests do not prove that functional section to be at fault, the next selection should be tested, and so on until the faulty functional section is located.

5) Localizing Trouble to the Circuit: Once the faulty functional section has been isolated, the task of localizing trouble to a circuit level becomes a matter of signal tracing the suspected

functional section. Toward this end, standard signal tracing methods should be employed, e.g., voltages and/or waveforms should be traced throughout the functional section, starting at the input and working towards the output of that section. Once the defective circuit is localized, the next step is replacement of a circuit board or component on a board. A normally functioning circuit is proof of proper fault isolation. The block diagrams, schematic diagrams and their associated discussions are provided for troubleshooting at the circuit level.

6) Failure Analysis: Before performing the actual repair or corrective action, review the process which led to the faulty component to determine why the fault caused the symptoms it did. In some cases a review of the process may prove that the faulty component is a result of a failure instead of the failure itself. In this instance, further troubleshooting is required. The review and proper failure records will also prove a valuable case history for future equipment failures.

4.7.2 Recommended Test Equipment

Refer to Section 4.3.1

4.7.3 Troubleshooting Chart

Table 4-2 Troubleshooting Chart gives some idea of the symptoms that occur should the instrument malfunction. Probable causes and remedies are also included on this chart.

	INPUT		MODEL 2521 CONTROLS		EXPECTED READING	
PARAGRAPH NO.	AMPLITUDE (mVrms)	FREQUENCY (Hz)	VEL MULT	FREQUENCY (Hz)	AMPLITUDE (ips pk)	FREQUENCY (Hz)
4.2.3 (Velocity Meter Test)	23 ±.5	1000 ±1	.2	- - -	.2	- - -
	115 ± 2	1000 ±1	1.0	- - -	1.0	- - -
	575 ±10	1000 ±1	5.0	- - -	5.0	- - -
4.2.4 (Spectral Velocity/ Frequency Test)	14.7 ±.2	30 ±1	5.0	150	4.25 ±.25	30 ± 4
	39.1 ±.4	80 ±1	5.0	150	4.25 ±.25	80 ± 6
	63.6 ±.7	130 ±1	5.0	150	4.25 ±.25	130 ± 7
	29.3 ±.3	300 ±3	1.0	1500	.85 ±.05	300 ±40
	78.2 ±.8	800 ±3	1.0	1500	.85 ±.05	800 ±60
	127.1 ±1.3	1300 ±3	1.0	1500	.85 ±.05	1300 ±70
	5.9 ±.1	300 ±3	0.2	1500	.17 ±.01	300 ±40
	15.65 ±.2	800 ±3	0.2	1500	.17 ±.01	800 ±60
	25.42 ±.3	1300 ±3	0.2	1500	.17 ±.01	1300 ±70
4.2.5 (Internal Calibrator Test)	- - -	- - -	1.0	150	.80 ±.04	20 ±3.6
	- - -	- - -	1.0	1500	.80 ±.04	200 ±36
4.2.6 (Acceler-ometer Test)	- - -	- - -	1.0	150	.85 ±.15	100 ±8

PERFORMANCE TEST CHART

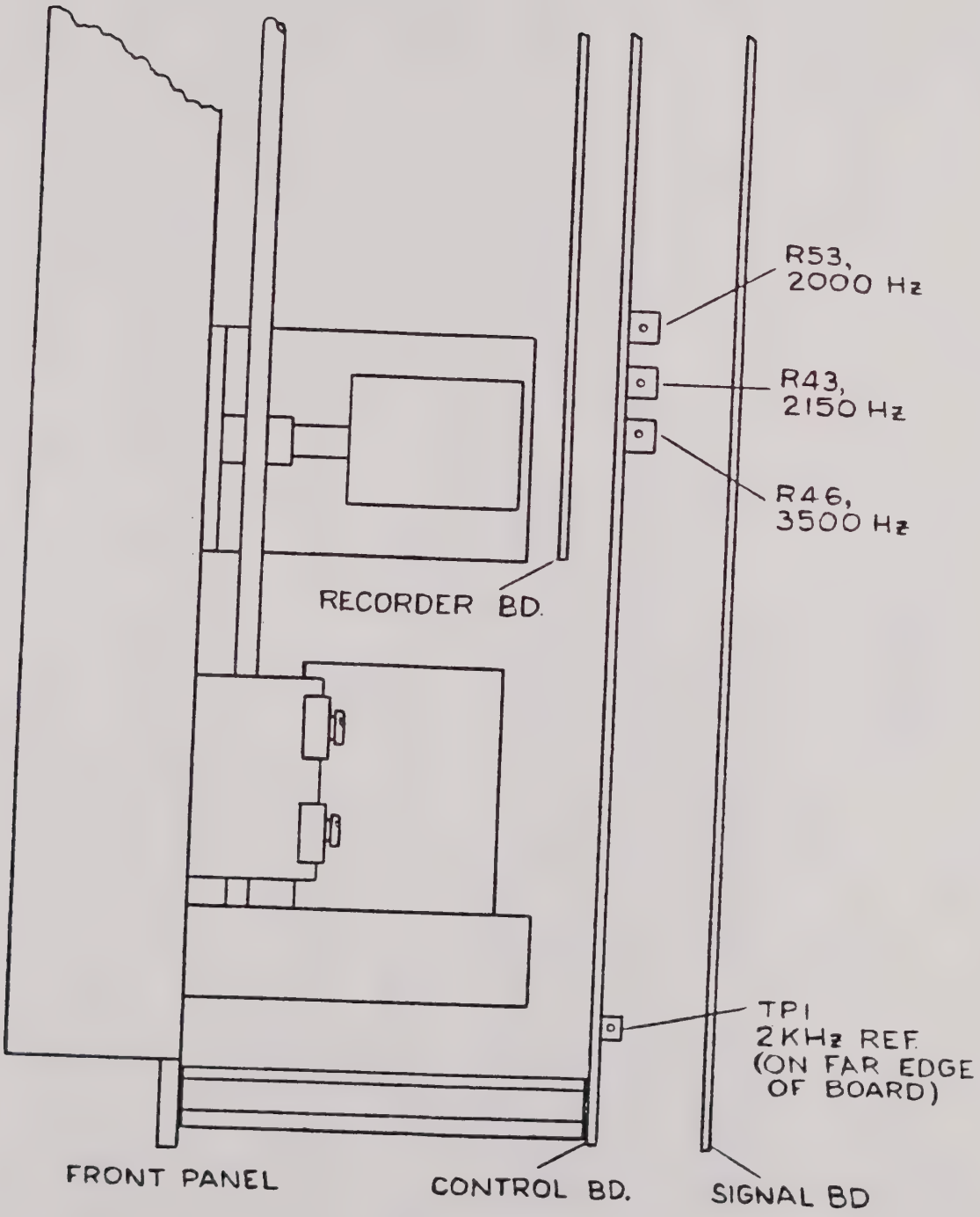
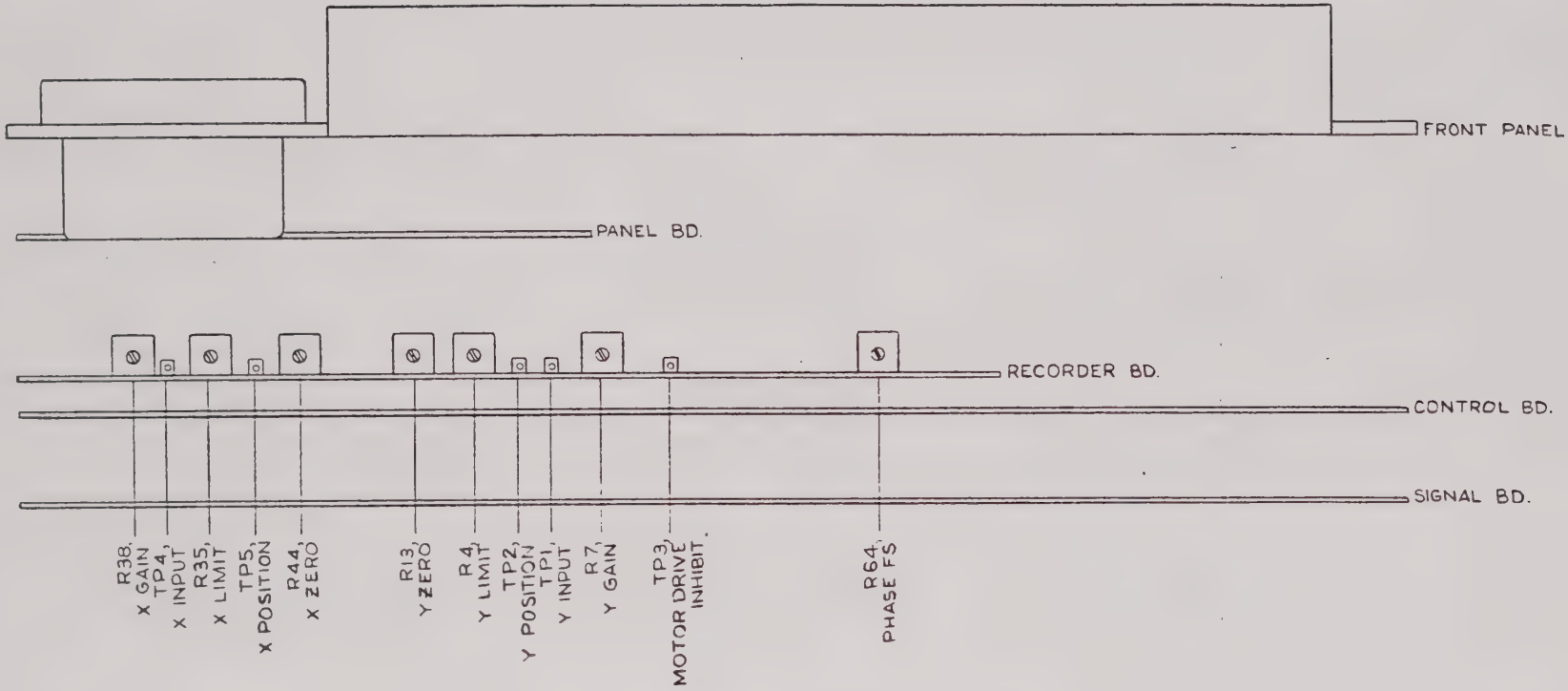
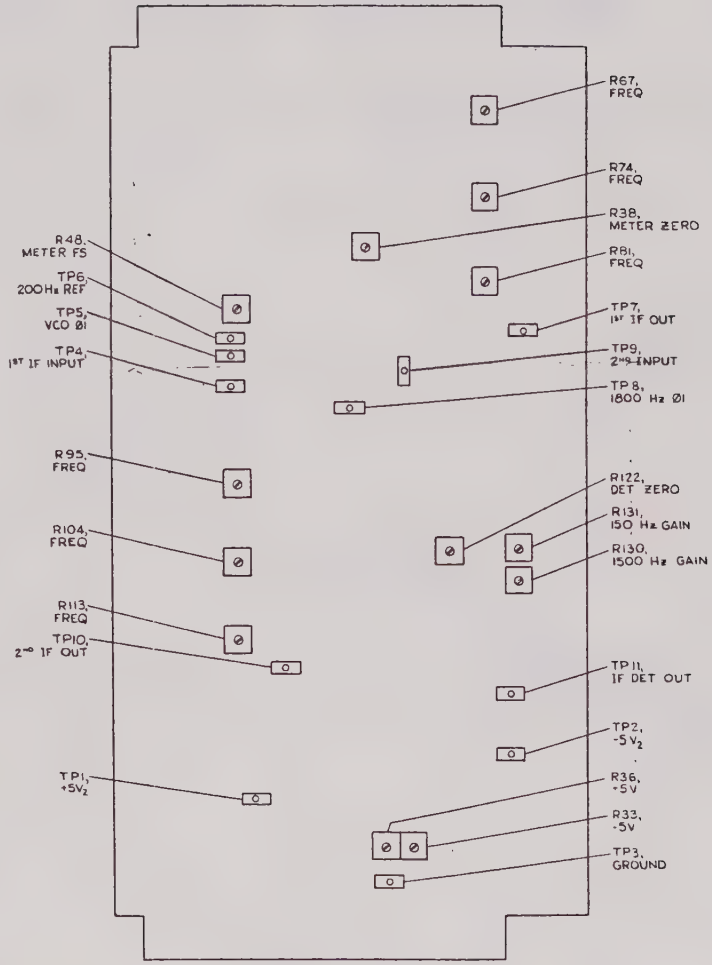


Figure 4-1. Front View Control-10265.



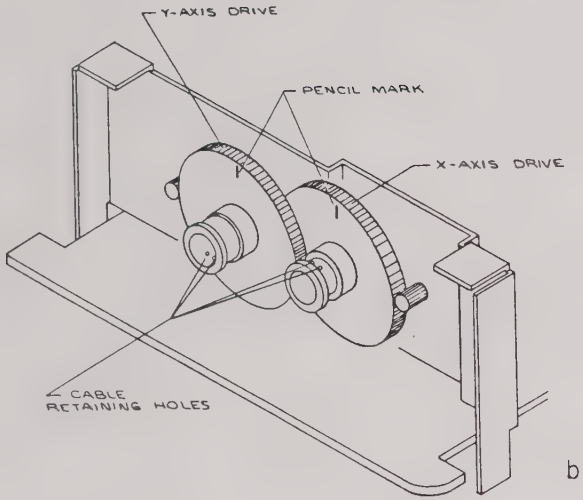
REAR VIEW
X-Y RECORDER
10267

P/O
FIGURE 4-1



BOTTOM VIEW
SIGNAL-10263

P/O
FIGURE 4-1
PW BOARDS AND ADJUSTMENT LOCATIONS



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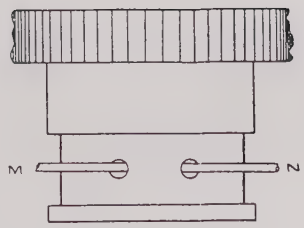

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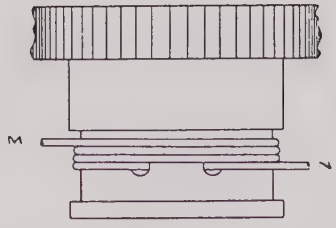

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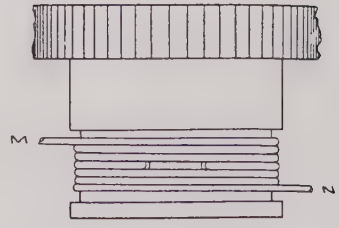

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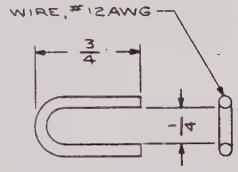

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TEMPORARY LOCKING CLIP

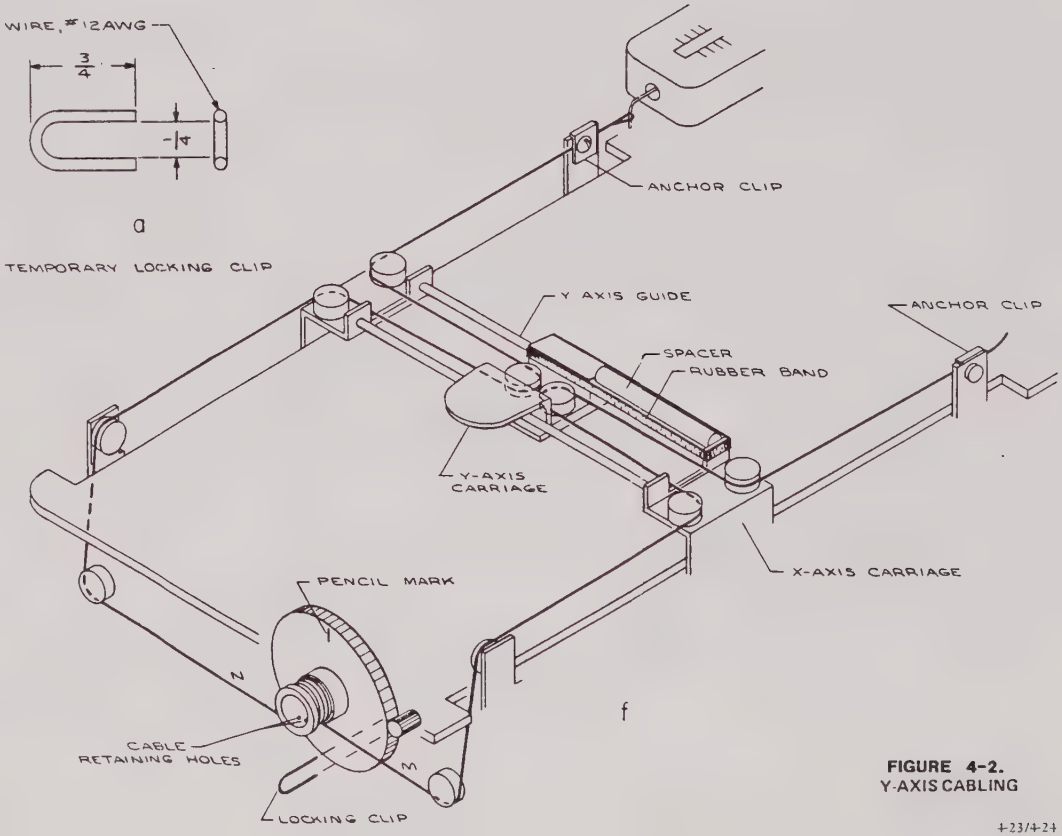

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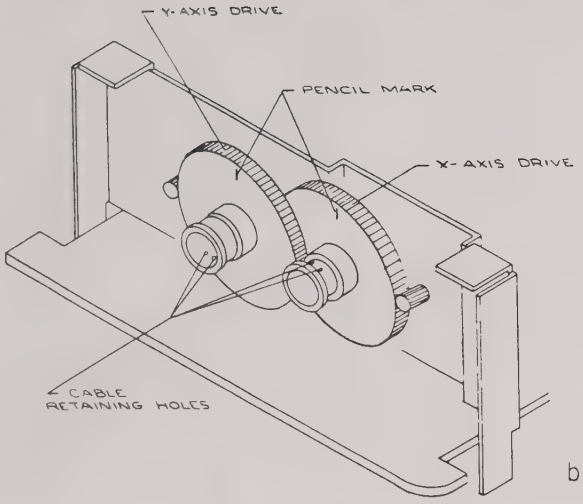
FIGURE 4-2.
Y-AXIS CABLING



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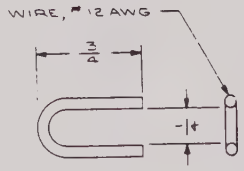

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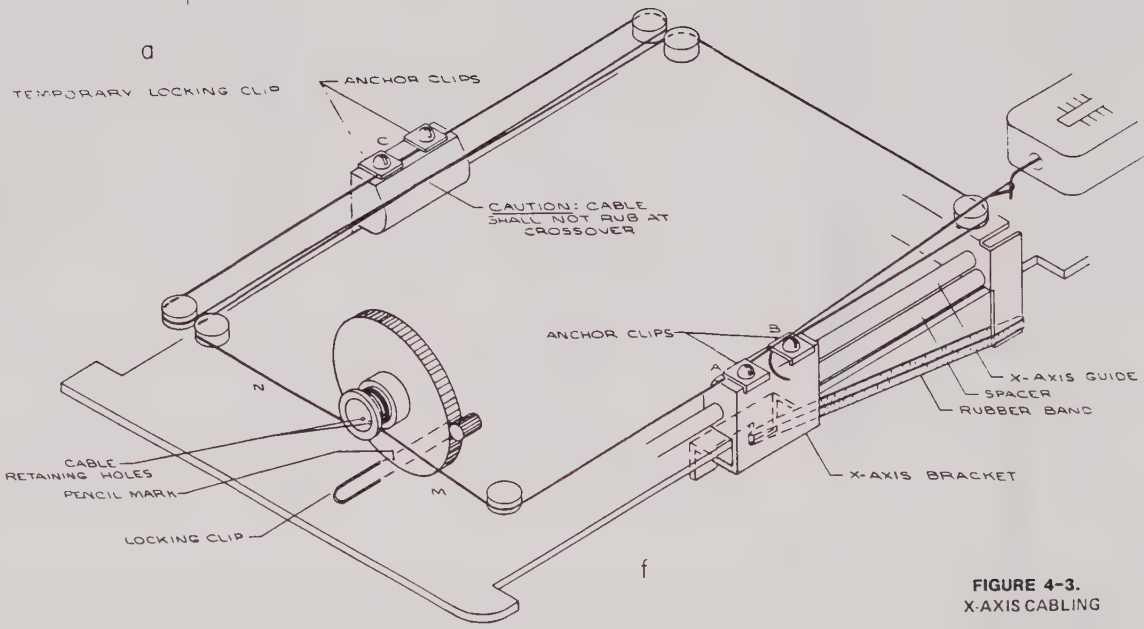

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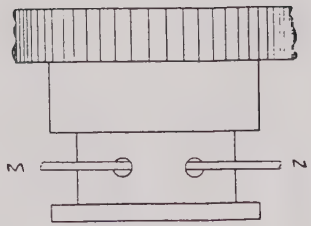

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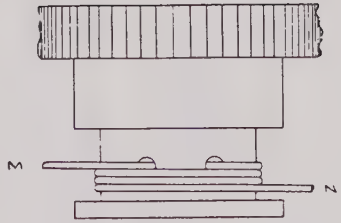

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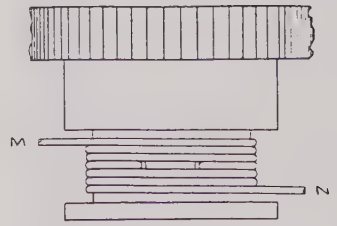

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FIGURE 4-3.
X-AXIS CABLING

Parts Lists and Circuit Diagrams

5.1 INTRODUCTION

This section contains parts lists, both electrical and mechanical and schematic diagrams. Semiconductor and integrated circuit legends are also provided to indicate component types used in this instrument.

5.2 RIBBON CABLE IDENTIFICATION

The identification and orientation of ribbon cable, and connectors are illustrated in Figure 5-1.

5.3 SCHEMATIC DIAGRAMS

Figures 5-1 through 5-14 are the schematic diagrams of the Model 2521. Unless otherwise specified, all resistance and capacitance values shown on the schematics are:

Resistance in "Ohms"
Capacitance in "Microfarads"
All 1% resistors have 1/8 watt ratings
All other resistors have 1/4 watt ratings

The schematic diagrams contain the following symbols:

K = X 1000
pF = Picofarads
⊘ = Screwdriver adjustment
* = Factory selected component
RPM F.S. = Border indicated front panel control

5.4 COMPONENT LOCATIONS

Component location drawings are to the left of each schematic drawing.

5.5 REPLACEABLE PARTS LIST, ELECTRICAL

Tables 5-1 through 5-14 are parts lists associated with schematic diagram Figures 5-1 through 5-14.

5.6 REPLACEABLE PARTS LIST, MECHANICAL

Table 5-15 is a mechanical parts list associated primarily with X-Y Recorder portion of the instrument. Refer to Figure 5-15 for the locations of these parts.

5.7 RECOMMENDED SPARE PARTS

Table 5-16 is a list of recommended spare parts and quantities per unit.

5.8 SEMICONDUCTOR AND INTEGRATED CIRCUIT LEGENDS

5.8.1 Semiconductor Legend (Refer to Table 5-17)

1) Changes and improvements in the semiconductor products available for commercial use necessitates type changes from time to time. To eliminate confusion and costly paperwork, many of these changes will be covered in the following legend. The purpose of this legend is to acknowledge the fact that the type number on a semiconductor found in a piece of equipment will not necessarily correspond with the type number given on the schematic diagram.

2) The legend is not intended to be an interchangeability list although in many cases good quality components within a given category may be substituted with acceptable results. Normally, replacements should be made using components having the same type number as the component being replaced.

3) Those components bearing an asterisk on the schematic diagram are factory selected components and should be obtained from Scientific-Atlanta, New Jersey Division.

4) It should be noted that our incoming inspection procedure includes noise screening on most semiconductors.

5.8.2 Integrated Circuit Legend (Refer to Table 5-18)

The I.C. legend is intended to give the reader some insight as to the internal functions of each I.C. used in this equipment and the function of each pin of the I.C.

TABLE 5-1 REPLACEABLE PARTS LIST

MAIN FRAME

SYMBOL	DESCRIPTION
	Board Ass'y, Signal Scientific-Atlanta A-10263
	Board Ass'y, Control Scientific-Atlanta A-10265
	Board Ass'y, X-Y Recorder Scientific-Atlanta A-10267
	Board Ass'y, Power Supply Scientific-Atlanta A-10269
	Board Ass'y, Panel Scientific-Atlanta A-10271
B1, B2	Motor (see Table 5-15 SYMBOL 30)
CR1	Diode, 1N4001
J1	Connector, Amphenol #11300
J2	Receptacle, Amphenol #80-871-385
J5	Jack, Switchcraft #UJ-2B
L1	Solenoid (see Table 5-15 SYMBOL 27)
M1	Meter (see Table 5-15 SYMBOL 17)
P4, P7, P15	Cable, Ribbon Scientific-Atlanta B-10281-3
P6	Cable, Scientific-Atlanta B-10280-2
P8, P12	Cable, Ribbon Scientific-Atlanta B-10281-2
P9, P10, P13	Cable, Ribbon Scientific-Atlanta B-10281-1
P11, P14	Cable, Scientific-Atlanta B-10280-1
P16	P/O Board Ass'y, Power Supply Scientific-Atlanta A-10267
R1	Resistor, Variable 10K ohms, Bournes #3520-5-1-103
R2, R3	Resistor, Variable (see Table 5-15 SYMBOL 34)
S1	Switch, (see Table 5-15 SYMBOL 41)

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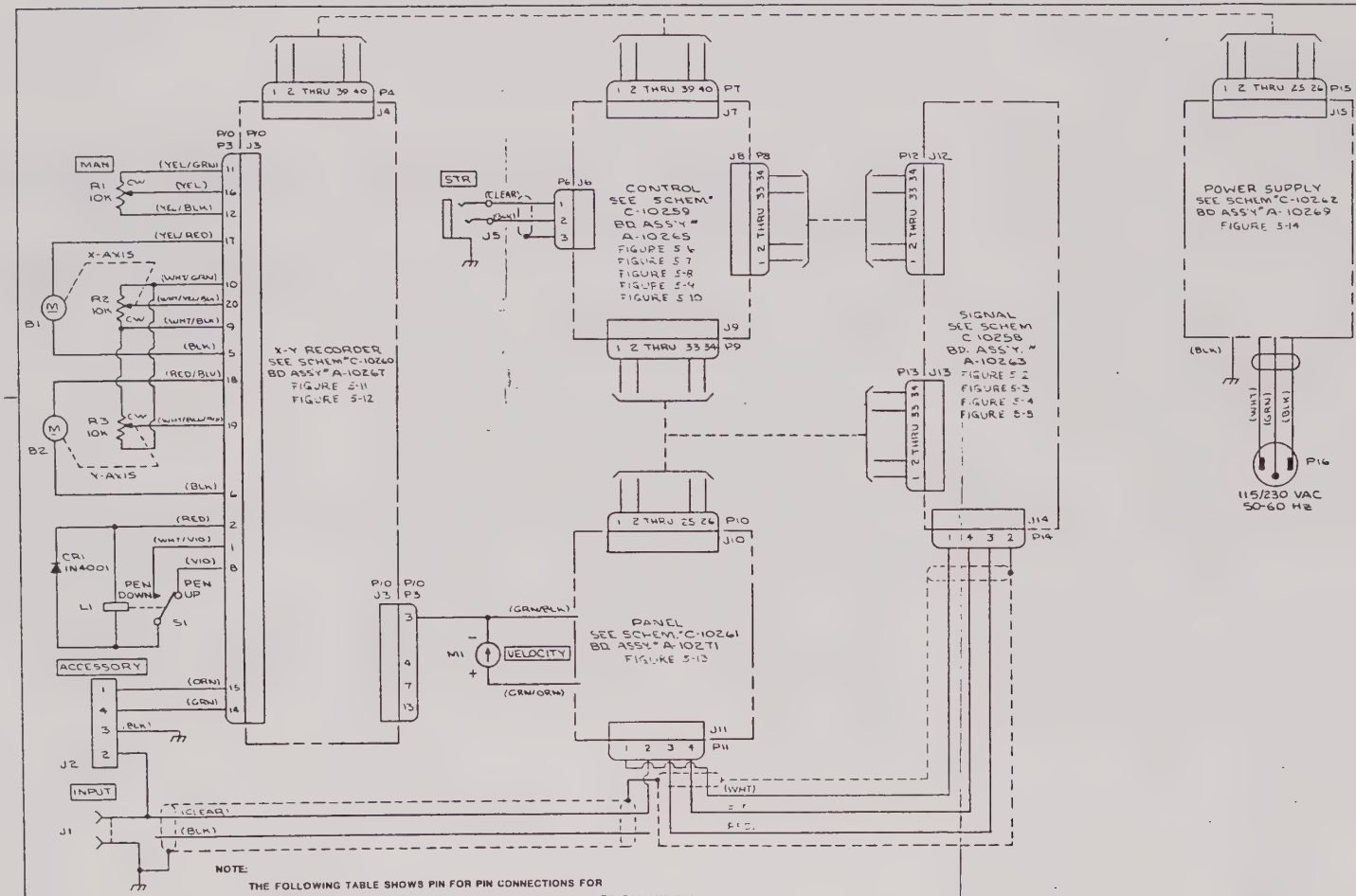

NOTE:

THE FOLLOWING TABLE SHOWS PIN FOR PIN CONNECTIONS FOR CONNECTORS LOCATED IN THE SAME CABLES P4,P7 AND P15, . P9, P10 AND P13, P8 AND P12 NOT LISTED ARE CONNECTED PIN FOR PIN 1 TO 1, 2 TO 2 ETC.

TABLE

P4	1	2	3	-	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
P7		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
P15																			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

P9	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
P10																			26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
P13	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					

FIGURE 5-1

TITLE: SCHEMATIC MAIN FRAME			
DRAWN: CRZ	DATE: 9-21-81	CODE IDENT NO: 13048	Scientific-Atlanta, In New Jersey Division Random Park West, Route 10, Randolph, N.J. 0
CHK: [illegible]	APPD: [illegible]		
MODEL: [illegible]	SHEET: [illegible]	SIZE: C	DWG NO: C-10257

TABLE 5-2 REPLACEABLE PARTS LIST

SIGNAL - INPUT SIGNAL CONDITIONING, VOLTAGE REGULATION

P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

Board, Printed Circuit, Scientific-Atlanta #10264

SYMBOL	DESCRIPTION
C1	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C2	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV220S
C3	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV220S
C4	Capacitor, .33 mF, ±1%, 50V, F-Dyne #MPE-13
C5	Capacitor, .33 mF, ±1%, 50V, F-Dyne #MPE-13
C6	Capacitor, 100 mF, 25V, Panasonic #ECEAIEV220S
C7	Capacitor, 510 pF, ±10%, 1KV, CRL #DD-511
C8	Capacitor, 15 mF, 15V, Sprague #196D
C9	Capacitor, 15 mF, 15V, Sprague #196D
C10	Capacitor, .22 mF, ±5%, 50V, F-Dyne #MPE-12
C11	Capacitor, 6800 pF, ±1%, 50V, F-Dyne #PS-11
C12	Capacitor, 6800 pF, ±1%, 50V, F-Dyne #PS-11
C13	Capacitor, 6800 pF, ±1%, 50V, F-Dyne #PS-11
C14	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C15	Capacitor, 15 mF, 15V, Sprague #196D
C16	Capacitor, 15 mF, 15V, Sprague #196D
C17	Capacitor, 15 mF, 15V, Sprague #196D
C18	Capacitor, 100 mF, 25V, Panasonic #ECEAIEV101S
C19	Capacitor, 100 mF, 25V, Panasonic #ECEAIEV101S
CR1	Diode, 1N914
CR2	Diode, 1N914
CR3	Diode, 1N914
CR4	Diode, 1N914
CR5	Diode, 1N914
CR6	Diode, IN914
CR7	Diode, 1N914
CR8	Diode, 1N914
CR9	Diode, 1N914
CR10	Diode, 1N914
CR11	Diode, 1N825
CR12	Diode, 1N749
CR13	Diode, 1N749
CR14	Diode, 1N914
CR15	Diode, 1N914
CR16	Diode, 1N914
IC1	Integrated Circuit, CD4001
IC2	Integrated Circuit, Scientific-Atlanta A-5662-2
IC3	Integrated Circuit, CD4066
IC4	Integrated Circuit, SN72747N

TABLE 5-2 REPLACEABLE PARTS LIST

SIGNAL - INPUT SIGNAL CONDITIONING, VOLTAGE REGULATION

SYMBOL	DESCRIPTION
J12	Header, 3M #3431-2302
J13	Header, 3M #3431-2302
J14	Header, Amp #640456-3
K1	Relay, G-B #814-2B
K2	Relay, G-B #814-2B
K3	Relay, G-B #814-2B
K4	Relay, G-B #814-2B
L1	Coil, Scientific-Atlanta A-10282-2
L2	Coil, Scientific-Atlanta A-10282-2
Q1	Transistor, Scientific-Atlanta B-5643-4-1
Q2	Transistor, MPSA18
Q3	Transistor, 2N5953
Q4	Transistor, MPSA18
Q5	Transistor, 2N3644
Q6	Transistor, 2N3644
Q7	Transistor, 2N5953
Q8	Transistor, TIP 32
Q9	Transistor, TIP 31
R1	Resistor, 1500Ω, ±10%, 1/4W, AB Type CB
R2	Resistor, 402KΩ, ±1%, 1/8W
R3	Resistor, 100KΩ, ±1%, 1/8W
R4	Resistor, 10Ω, ±10%, 1/4W, AB Type CB
R5	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R6	Resistor, 120KΩ, ±10%, 1/4W, AB Type CB
R7	Resistor, 4530Ω, ±1%, 1/8W
R8	Resistor, 1 MegΩ, ±1C%, 1/4W, AB Type CB
R9	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R10	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R11	Resistor, 11KΩ, ±1%, 1/8W
R12	Resistor, 11KΩ, ±1%, 1/8W
R13	Resistor, 11.5KΩ, ±1%, 1/8W
R14	Resistor, 9090Ω, ±1%, 1/8W
R15	Resistor, 15.4KΩ, ±1%, 1/8W
R16	Resistor, 100KΩ, ±1%, 1/8W
R17	Resistor, 499KΩ, ±1%, 1/8W
R18	Resistor, 22.1KΩ, ±1%, 1/8W
R19	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R20	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R21	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R22	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R23	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R24	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB

TABLE 5-2 REPLACEABLE PARTS LIST

SIGNAL - INPUT SIGNAL CONDITIONING, VOLTAGE REGULATION

SYMBOL	DESCRIPTION
R25	Resistor, 15KΩ, ±10%, 1/4W, AB Type CB
R26	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R27	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R28	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R29	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R30	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R31	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R32	Resistor, 2000Ω, ±1%, 1/8W
R33	Resistor, Variable, 2000Ω, Beckman #72PM
R34	Resistor, 10KΩ, ±1%, 1/8W
R35	Resistor, 4990Ω, ±1%, 1/8W
R36	Resistor, Variable, 1000Ω, Beckman #72PM
R37	Resistor, 4990Ω, ±1%, 1/8W
TP1	Jack, Test Point, Johnson #105-0572-001
TP2	Jack, Test Point, Johnson #105-0572-001
TP3	Jack, Test Point, Johnson #105-0572-001

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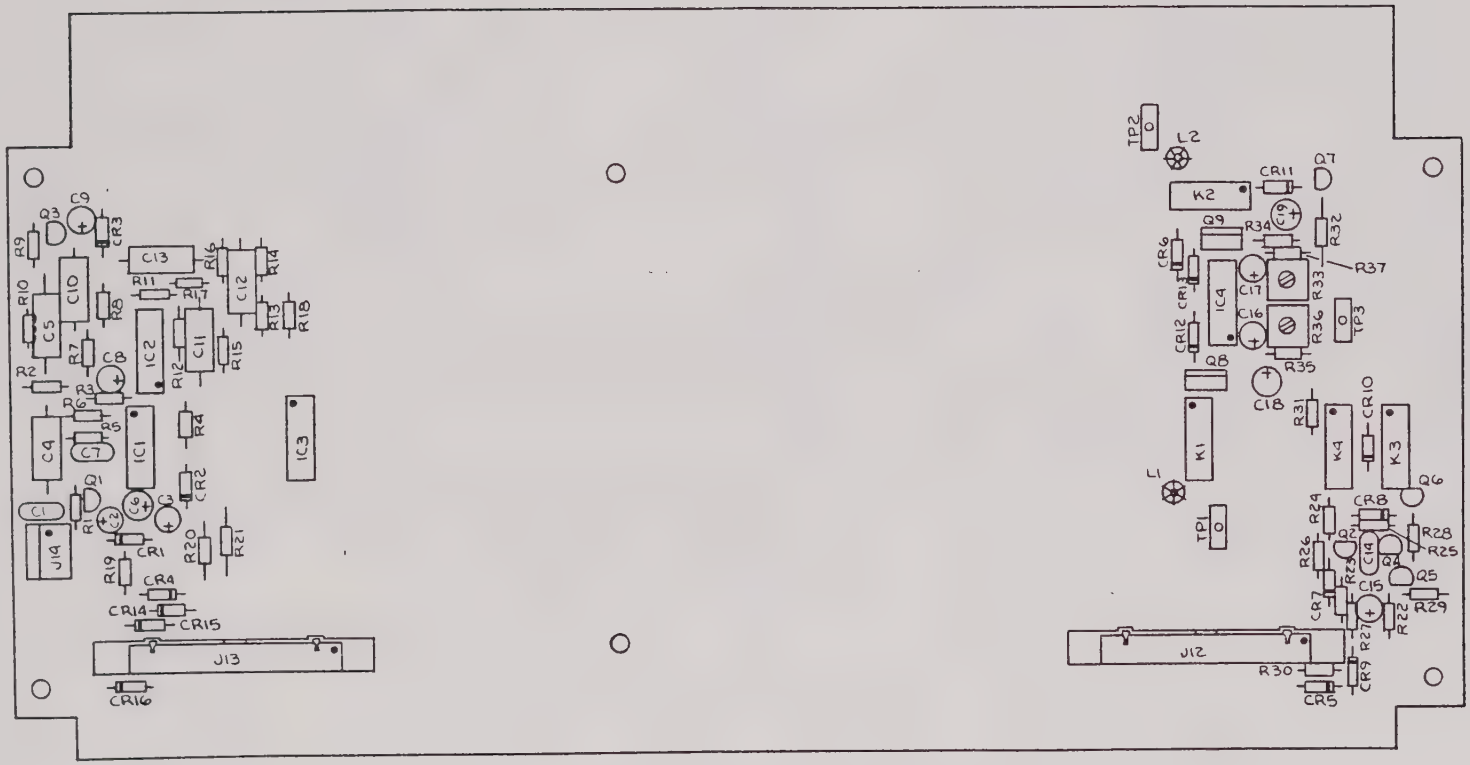

C9
Q3
CR3
R9
C13
R16
R14
R10
C10
R11
C12
C5
R8
R7
C11
R15
R13
R18
C8
R2
R3
R6
R5
C4
IC1
R4
IC2
IC3
CR2
Q1
C2
C3
R1
C1
CR1
R20
R21
J14
R19
CR4
CR14
CR15
J13
CR16
TP2
L2
CR11
Q7
K2
Q9
R34
C19
R32
CR6
R37
IC4
C17
R33
CR12
CR13
C16
R36
TP3
R35
Q8
C18
R31
CR10
K1
K4
K3
L1
Q6
TP1
CR8
R24
R28
R25
R26
Q2
CR7
C14
C15
Q4
Q5
R27
R22
R29
J12
R30
CR5
CR9

P/O FIGURE 5-2.

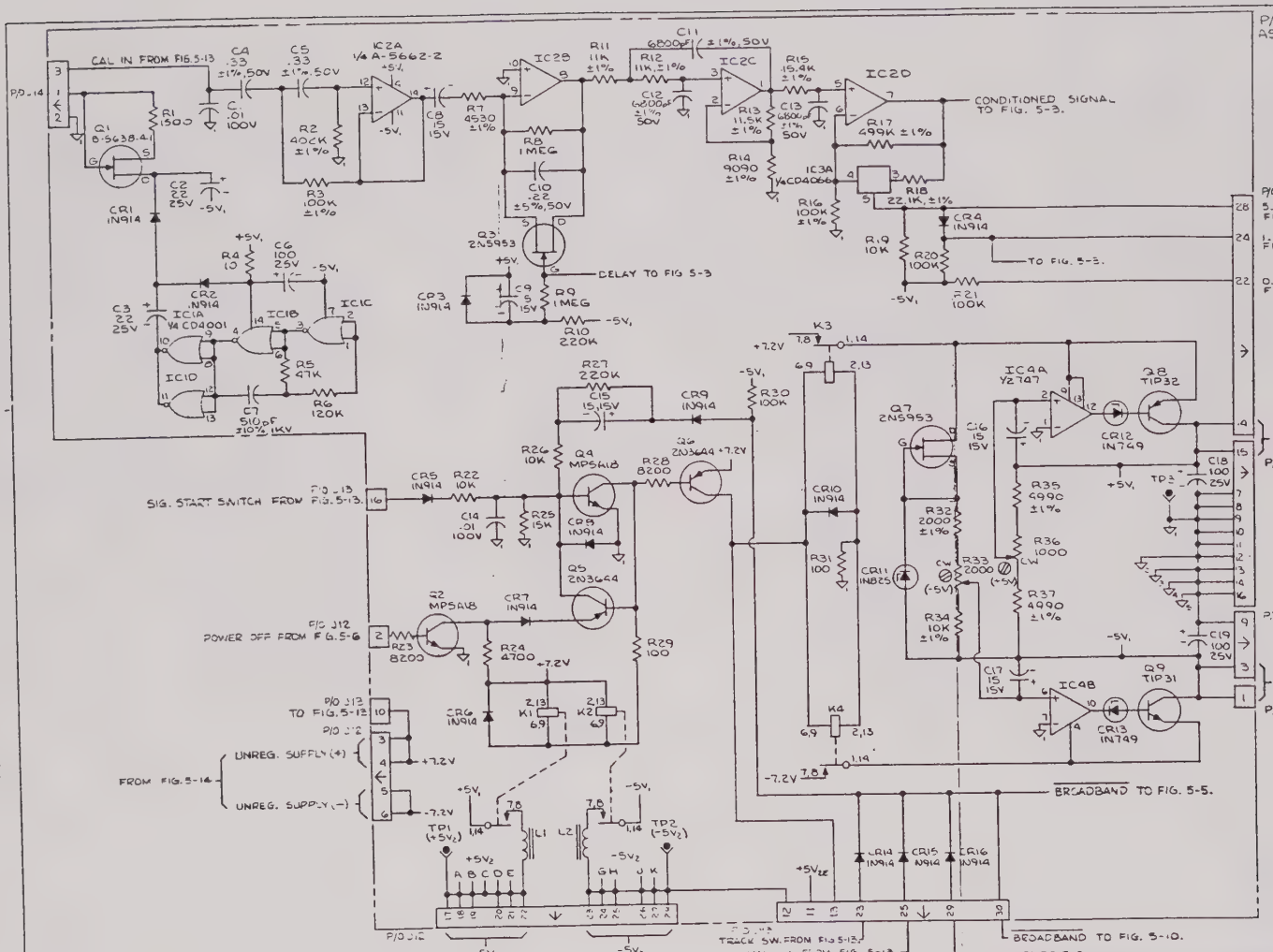


FIGURE 5-2

SCHEMATIC, SIGNAL INPUT SIGNAL CONDITIONING VOLTAGE REGULATION

MJM	9-22-81	CODE IDENT NO	Scientific-Atlanta, In
DRZ	BK	13048	Atlanta Georgia

TABLE 5-3 REPLACEABLE PARTS LIST

SIGNAL - BROADBAND DETECTOR 1st MODULATOR, CALIBRATE

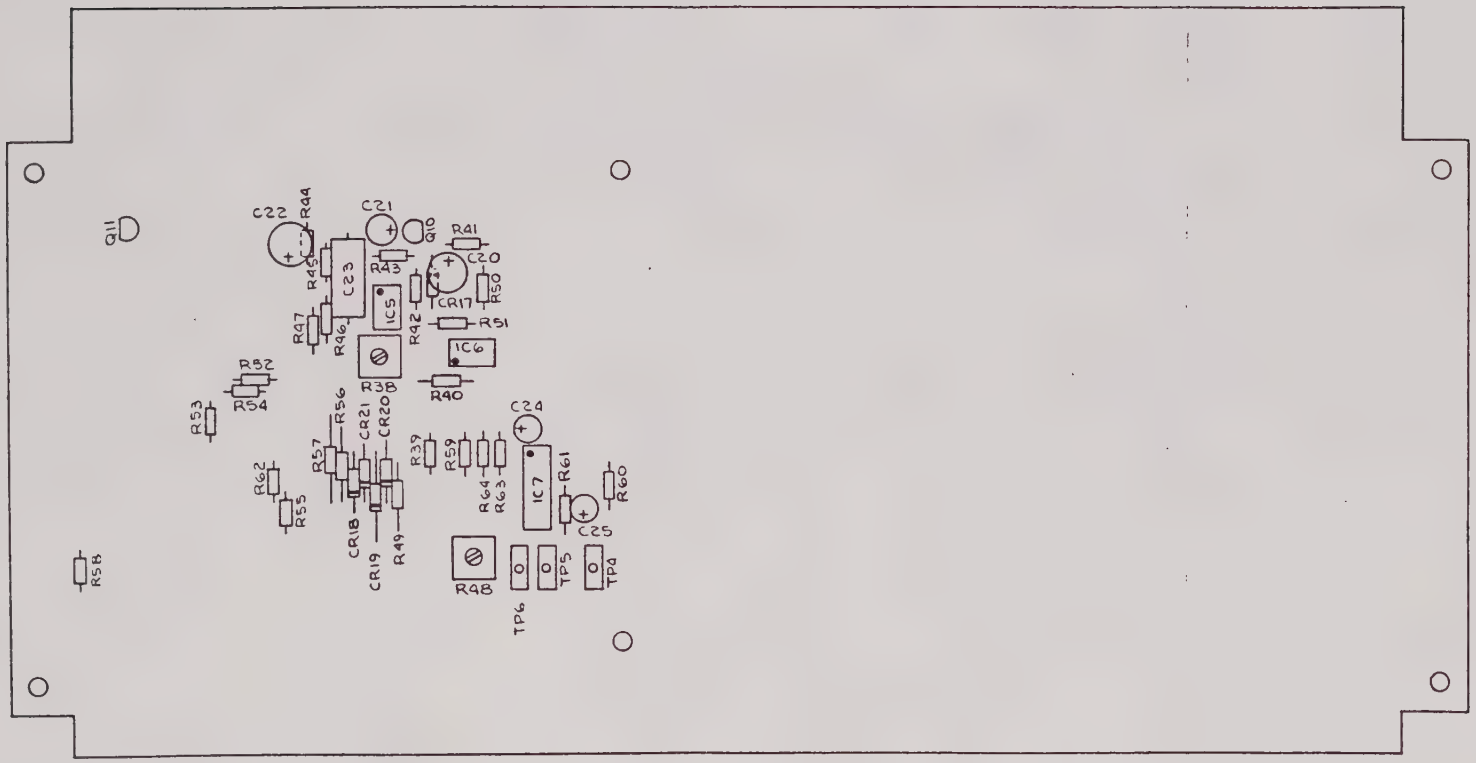
P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

SYMBOL	DESCRIPTION
C20	Capacitor, 100 mF, 10V, Sprague #196D
C21	Capacitor, 100 mF, 25V, Panasonic #ECEAIEV101S
C22	Capacitor, 100 mF, 10V, Sprague #196D
C23	Capacitor, .5 mF, ±20%, 50V, F-Dyne #MPE-13
C24	Capacitor, 15 mF, 15V, Sprague #196D
C25	Capacitor, 15 mF, 15V, Sprague #196D
CR17	Diode, 1N276
CR18	Diode, 1N914
CR19	Diode, 1N914
CR20	Diode, 1N914
CR21	Diode, 1N914
IC3	Integrated Circuit, CD4066 (see Table 5-2)
IC5	Integrated Circuit, Scientific-Atlanta A-5663-2
IC6	Integrated Circuit, Scientific-Atlanta A-5663-3
IC7	Integrated Circuit, CD4066
Q10	Transistor, MPSA18
Q11	Transistor, 2N5953
R38	Resistor, Variable, 100KΩ, Beckman #72PM
R39	Resistor, 1MegΩ, ±10%, 1/4W, AB Type CB
R40	Resistor, 2700Ω, ±10%, 1/4W, AB Type CB
R41	Resistor, 1000Ω, ±1%, 1/8W
R42	Resistor, 1820Ω, ±1%, 1/8W
R43	Resistor, 220Ω, ±10%, 1/4W, AB Type CB
R44	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R45	Resistor, 11KΩ, ±1%, 1/8W
R46	Resistor, 27.4KΩ, ±1%, 1/8W
R47	Resistor, 162KΩ, ±1%, 1/8W
R48	Resistor, Variable, 1000Ω, Beckman #72PM
R49	Resistor, 1910Ω, ±1%, 1/8W
R50	Resistor, 10KΩ, ±1%, 1/8W
R51	Resistor, 10KΩ, ±1%, 1/8W
R52	Resistor, 287KΩ, ±1%, 1/8W
R53	Resistor, 23.7KΩ, ±1%, 1/8W
R54	Resistor, 4530Ω, ±1%, 1/8W
R55	Resistor, 10KΩ, ±10%, 1/4W AB Type CB
R56	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R57	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R58	Resistor, 402Ω, ±1%, 1/8W
R59	Resistor, 10KΩ, ±1%, 1/8W
R60	Resistor, 10KΩ, ±1%, 1/8W

TABLE 5-3 REPLACEABLE PARTS LIST

SIGNAL - BROADBAND DETECTOR 1st MODULATOR, CALIBRATE

SYMBOL	DESCRIPTION
R61	Resistor, 330KΩ, ±10%, 1/4W AB Type CB
R62	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R63	Resistor, 4990Ω, ±1%, 1/8W
R64	Resistor, 20KΩ, ±10%, 1/4W, AB Type CB
TP4	Jack, Test Point, Johnson #105-0572-001
TP5	Jack, Test Point, Johnson #105-0572-001
TP6	Jack, Test Point, Johnson #105-0572-001


Q11
C22
R44
C21
Q10
R41
R45
C23
R43
C20
IC5
CR17
R50
R47
R46
R42
R51
IC6
R52
R54
R40
R53
C24
R56
CR21
CR20
R57
R39
R59
R64
R63
IC7
R61
R60
R62
R55
CR18
CR19
R49
C25
R58
R48
TP6
TP5
TP4

P/O FIGURE 5-3.

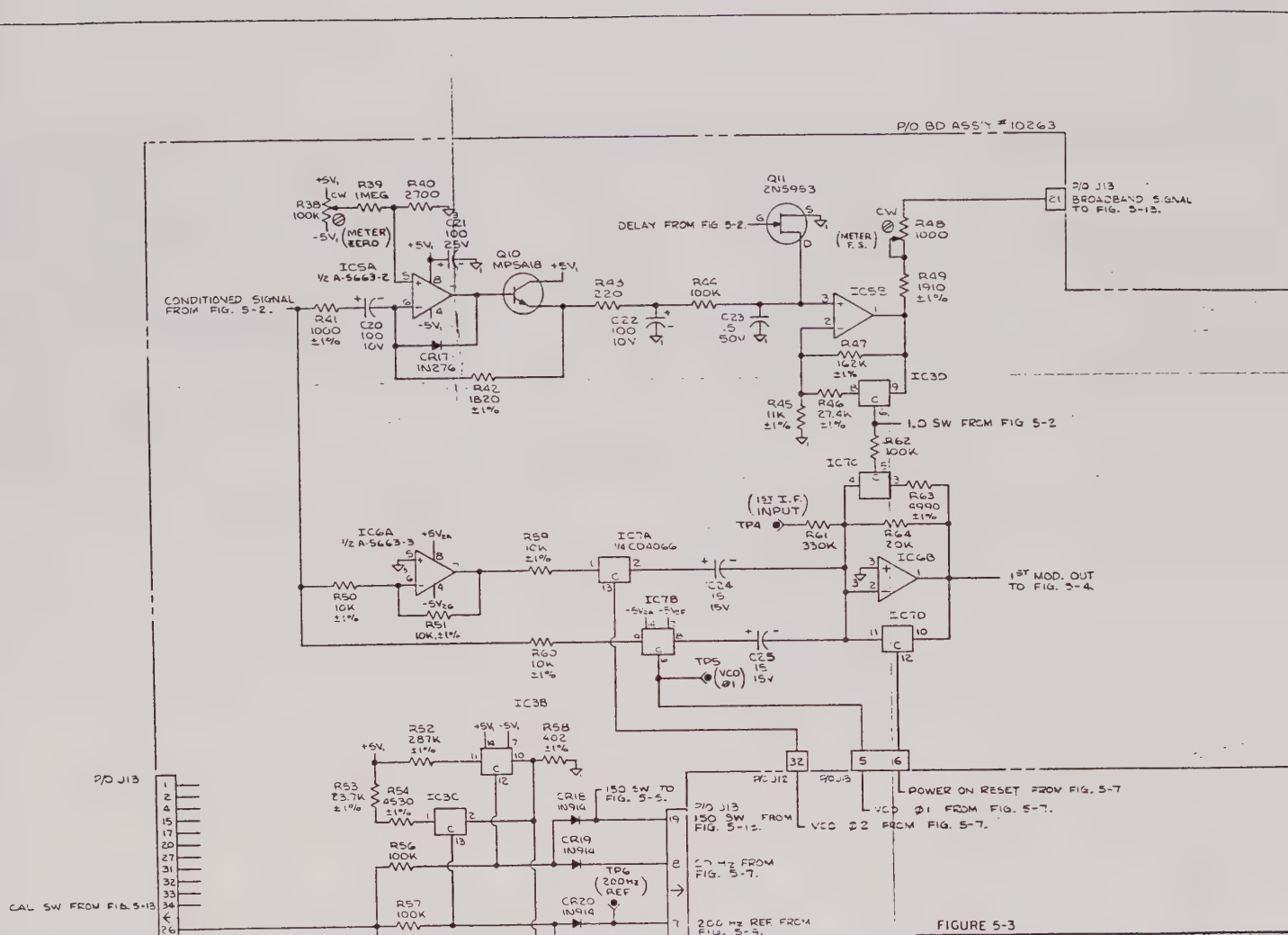


FIGURE 5-3

TITLE: SCHEMATIC, SIGNAL-BROADBAND DETECTOR, 1ST MODULATOR CALIBRATE			
DRAWN MJM	DATE 9-22-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc. New Jersey Division, Rancocas Park West, Route 41, Riverside, N.J. 08
CHK DRZ	APPD BK		
MODEL 2521	SHEET 2 of 4	DWG NO C-10258	REV A

5:19/5-

TABLE 5-4 REPLACEABLE PARTS LIST

SIGNAL - 1st IF FILTER, 2nd MODULATOR

P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

SYMBOL	DESCRIPTION
C26	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C27	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C28	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C29	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C30	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C31	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B103F
C32	Capacitor, 15 mF, 15V, Sprague #196D
C33	Capacitor, 15 mF, 15V, Sprague #196D
IC8	Integrated Circuit, TL084
IC9	Integrated Circuit, TL084
IC10	Integrated Circuit TL084
IC11	Integrated Circuit, Scientific-Atlanta A-5663-2
IC12	Integrated Circuit, CD4066
R65	Resistor, 90.9KΩ, ±1%, 1/8W
R66	Resistor, 7500Ω, ±1%, 1/8W
R67	Resistor, Variable, 1000Ω, Beckman #72PM
R68	Resistor, 90.9KΩ, ±1%, 1/8W
R69	Resistor, 10KΩ, ±1%, 1/8W
R70	Resistor, 10KΩ, ±1%, 1/8W
R71	Resistor, 8060Ω, ±1%, 1/8W
R72	Resistor, 90.9KΩ, ±1%, 1/8W
R73	Resistor, 7500Ω, ±1%, 1/8W
R74	Resistor, Variable, 1000Ω, Beckman #72PM
R75	Resistor, 90.9KΩ, ±1%, 1/8W
R76	Resistor, 10KΩ, ±1%, 1/8W
R77	Resistor, 10KΩ, ±1%, 1/8W
R78	Resistor, 8060Ω, ±1%, 1/8W
R79	Resistor, 90.9KΩ, ±1%, 1/8W
R80	Resistor, 7500Ω, ±1%, 1/8W
R81	Resistor, Variable, 1000Ω, Beckman #72PM
R82	Resistor, 90.9KΩ, ±1%, 1/8W
R83	Resistor, 10KΩ, ±1%, 1/8W
R84	Resistor, 10KΩ, ±1%, 1/8W
R85	Resistor, 8060Ω, ±1%, 1/8W
R86	Resistor, 10KΩ, ±1%, 1/8W
R87	Resistor, 10KΩ, ±1%, 1/8W
R88	Resistor, 10KΩ, ±1%, 1/8W
R89	Resistor, 10KΩ, ±1%, 1/8W
R90	Resistor, 680KΩ, ±10%, 1/4W AB Type CB
R91	Resistor, 15.4KΩ, ±1%, 1/8W
TP7	Jack, Test Point, Johnson #105-0572-001
TP8	Jack, Test Point, Johnson #105-0572-001
TP9	Jack, Test Point, Johnson #105-0572-001

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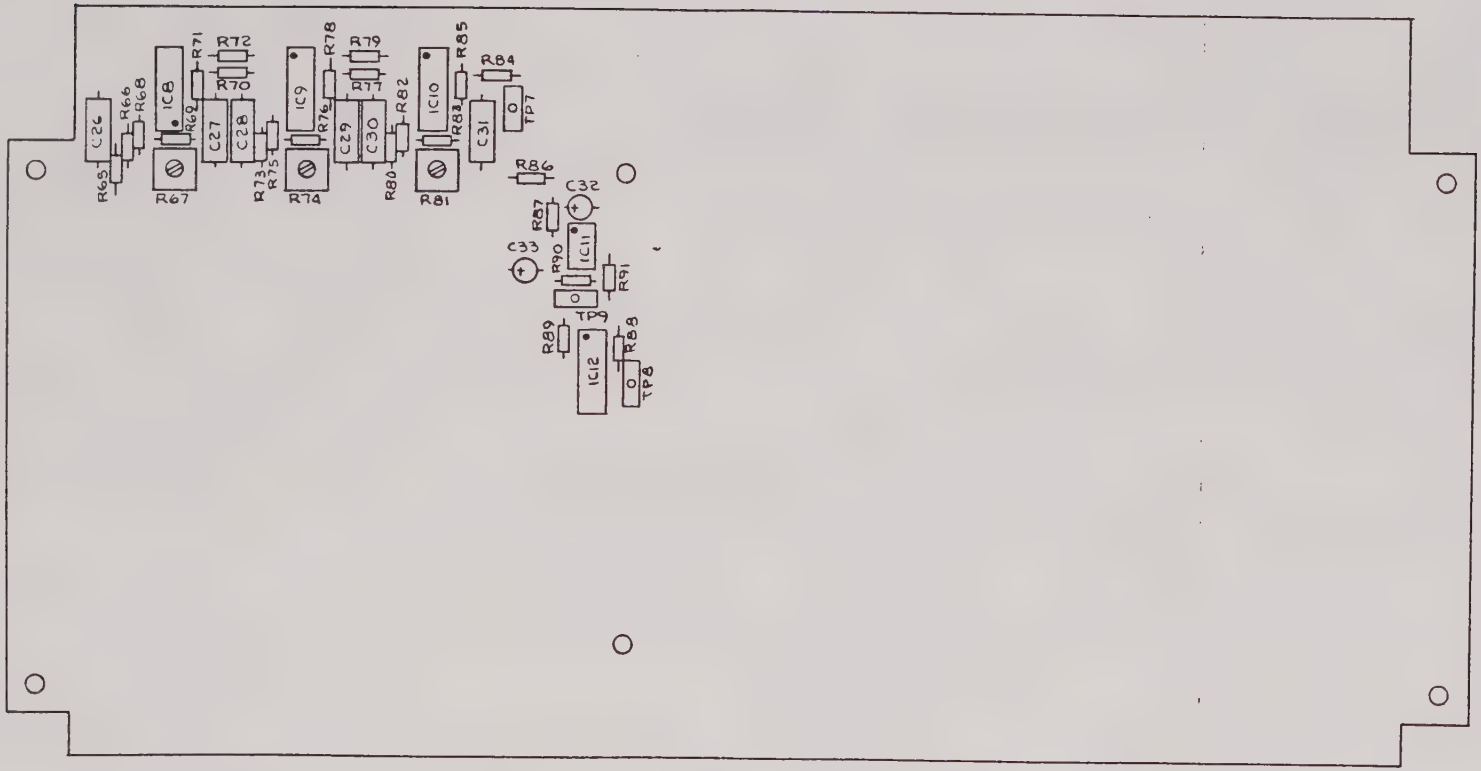

C26
R65
R66
R68
IC8
R69
R67
R71
R72
R70
C27
C28
R73
R75
IC9
R76
R74
R78
R79
R77
C29
C30
R80
R82
IC10
R83
R81
R85
R84
C31
TP7
R86
C32
R87
C33
R90
IC11
R91
TP9
R89
IC12
R88
TP8

P/O FIGURE 5-4.

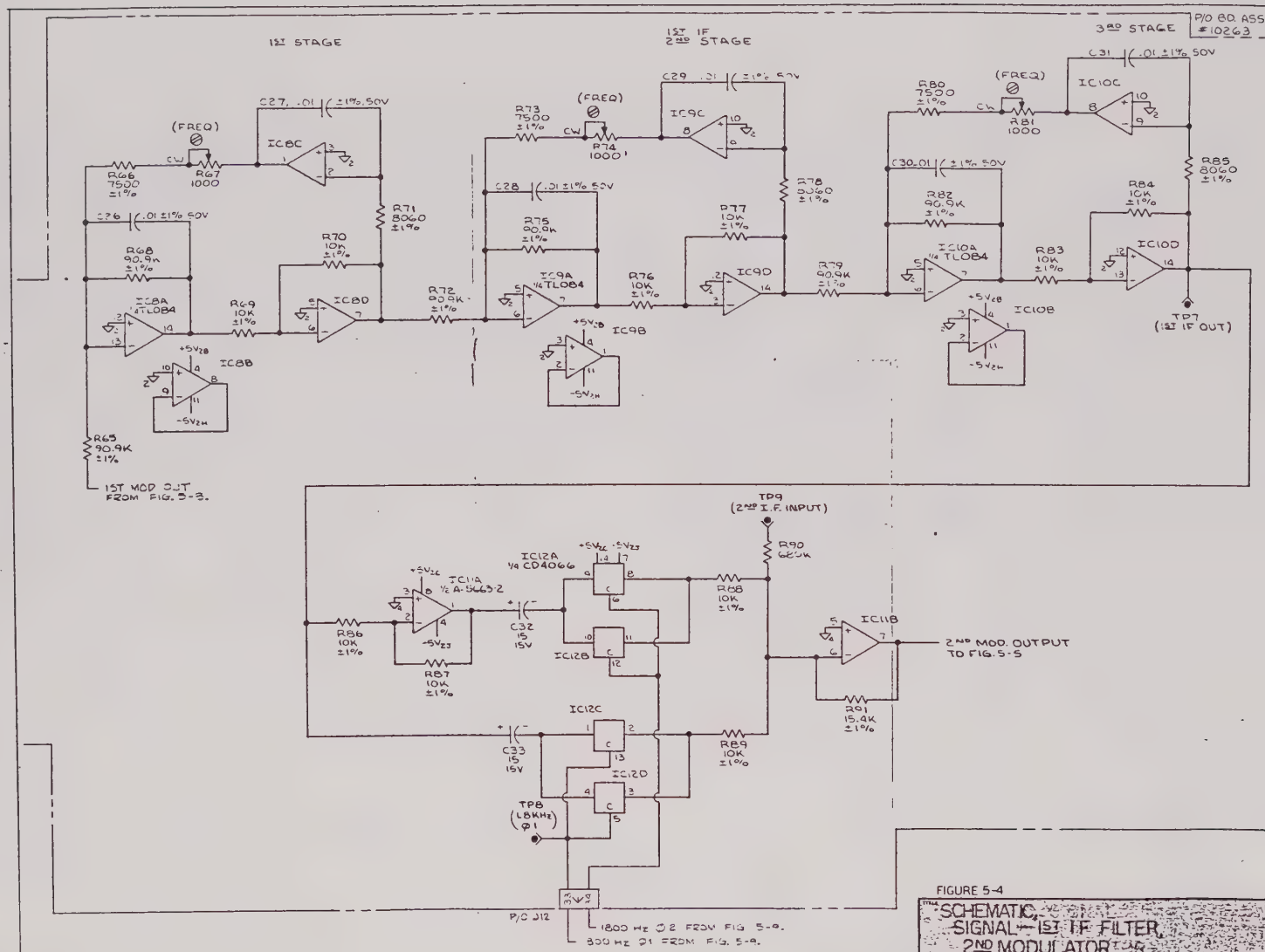


FIGURE 5-4

SCHEMATIC, SIGNAL — 1ST IF FILTER, 2ND MODULATOR PCA

DRAWN MJM	DATE 9-22-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc.
CHK DRZ	APVD DZ		
MODEL 1521	SHEET 1 OF 1	DWG NO C-10268	REV A

TABLE 5-5 REPLACEABLE PARTS LIST

SIGNAL - 2nd IF FILTER, IF DETECTOR

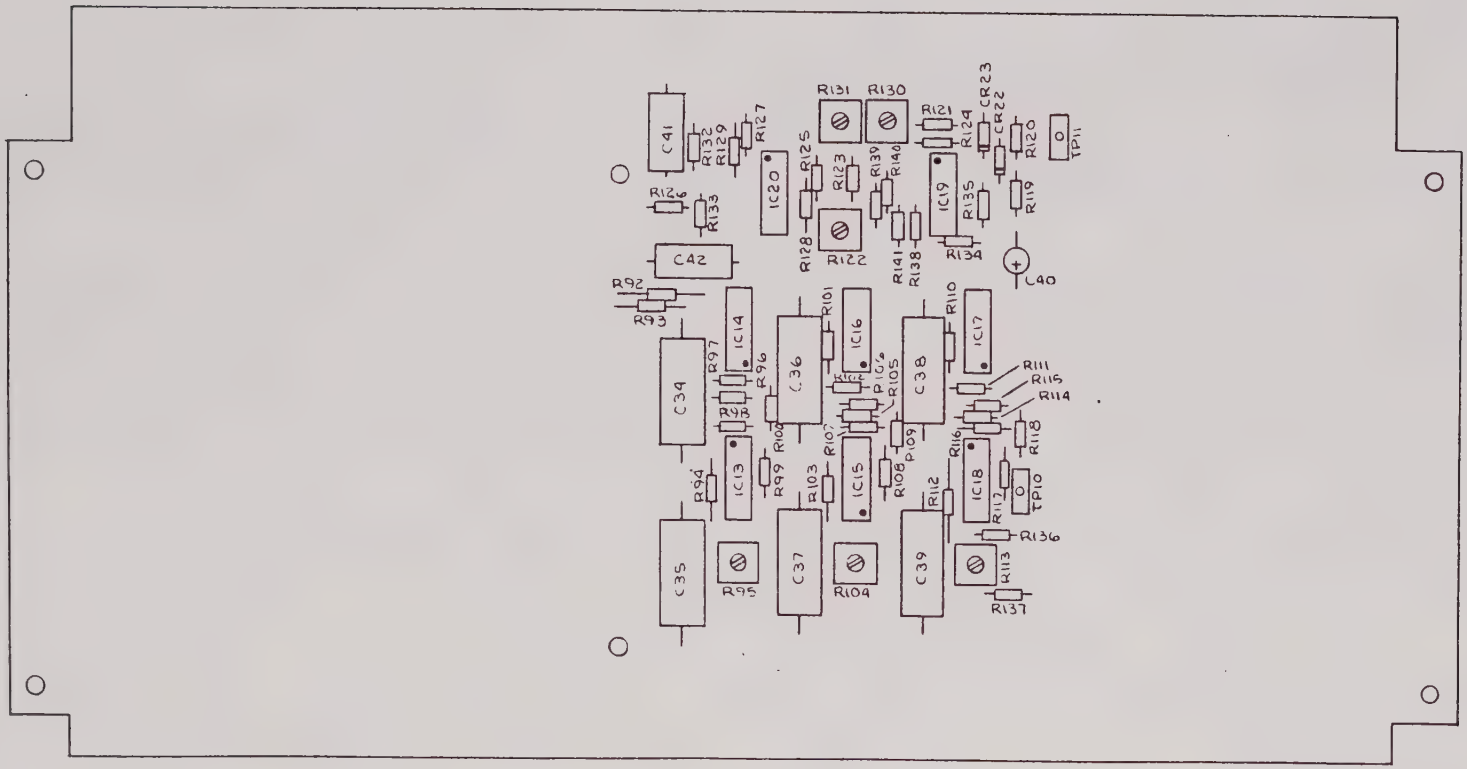
P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

SYMBOL	DESCRIPTION
C34	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C35	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C36	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C37	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C38	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C39	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C40	Capacitor, 15 mF, 15V, Sprague #196D
C41	Capacitor, 1 mF, ±5%, 50V, F-Dyne #MPE-13
C42	Capacitor, 1 mF, ±5%, 50V, F-Dyne #MPE-13
CR22	Diode, 1N914
CR23	Diode, 1N914
IC13	Integrated Circuit, TL084
IC14	Integrated Circuit, CD4066
IC15	Integrated Circuit, TL084
IC16	Integrated Circuit, CD4066
IC17	Integrated Circuit, CD4066
IC18	Integrated Circuit, TL084
IC19	Integrated Circuit, TL084
IC20	Integrated Circuit, CD4066
R92	Resistor, 61.9KΩ, ±1%, 1/8W
R93	Resistor, 316KΩ, ±1%, 1/8W
R94	Resistor, 7500Ω, ±1%, 1/8W
R95	Resistor, Variable, 1000Ω, Beckman #72PM
R96	Resistor, 316KΩ, ±1%, 1/8W
R97	Resistor, 61.9KΩ, ±1%, 1/8W
R98	Resistor, 10KΩ, ±1%, 1/8W
R99	Resistor, 8060Ω, ±1%, 1/8W
R100	Resistor, 10KΩ, ±1%, 1/8W
R101	Resistor, 31.6KΩ, ±1%, 1/8W
R102	Resistor, 158KΩ, ±1%, 1/8W
R103	Resistor, 7500Ω, ±1%, 1/8W
R104	Resistor, Variable, 1000Ω, Beckman #72PM
R105	Resistor, 316KΩ, ±1%, 1/8W
R106	Resistor, 61.9KΩ, ±1%, 1/8W
R107	Resistor, 10KΩ, ±1%, 1/8W
R108	Resistor, 8060Ω, ±1%, 1/8W
R109	Resistor, 10KΩ, ±1%, 1/8W
R110	Resistor, 15.4KΩ, ±1%, 1/8W
R111	Resistor, 80.6KΩ, ±1%, 1/8W
R112	Resistor, 7500Ω, ±1%, 1/8W
R113	Resistor, Variable, 1000Ω, Beckman #72PM
R114	Resistor, 316KΩ, ±1%, 1/8W

TABLE 5-5 REPLACEABLE PARTS LIST

SIGNAL - 2nd IF FILTER, IF DETECTOR

SYMBOL	DESCRIPTION
R115	Resistor, 61.9KΩ, ±1%, 1/8W
R116	Resistor, 10KΩ, ±1%, 1/8W
R117	Resistor, 8060Ω, ±1%, 1/8W
R118	Resistor, 10KΩ, ±1%, 1/8W
R119	Resistor, 10KΩ, ±1%, 1/8W
R120	Resistor, 20KΩ, ±1%, 1/8W
R121	Resistor, 38.3KΩ, ±1%, 1/8W
R122	Resistor, Variable, 20KΩ, Beckman #72PM
R123	Resistor, 2.2 MegΩ, ±10%, 1/4W, AB Type CB
R124	Resistor, 38.3KΩ, ±1%, 1/8W
R125	Resistor, 45.3KΩ, ±1%, 1/8W
R126	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R127	Resistor, 1000Ω, ±1%, 1/8W
R128	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R129	Resistor, 1000Ω, ±1%, 1/8W
R130	Resistor, Variable, 20KΩ, Beckman #72PM
R131	Resistor, Variable, 20KΩ, Beckman #72PM
R132	Resistor, 26.7KΩ, ±1%, 1/8W
R133	Resistor, 26.7KΩ, ±1%, 1/8W
R134	Resistor, 9090Ω, ±1%, 1/8W
R135	Resistor, 15.4KΩ, ±1%, 1/8W
R136	Resistor, 390Ω, ±10%, 1/4W, AB Type CB
R137	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R138	Resistor, 15Ω, ±10%, 1/4W, AB Type CB
R139	Resistor, 49.9KΩ, ±1%, 1/8W
R140	Resistor, 499Ω, ±1%, 1/8W
R141	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB


C41
R132
R129
R127
R131
R130
R121
CR23
CR22
R124
R120
TP11
R125
R123
R139
R140
IC19
R135
R119
R126
R133
IC20
R128
R122
R141
R138
R134
C40
C42
R92
R93
IC14
R101
IC16
R110
IC17
C34
R97
R96
C36
R105
C38
R111
R115
R114
R102
R107
R109
R116
R118
R94
IC13
R99
R103
IC15
R108
IC18
TP10
R112
R117
R136
C35
R95
C37
R104
C39
R113
R137

P/O FIGURE 5-5.

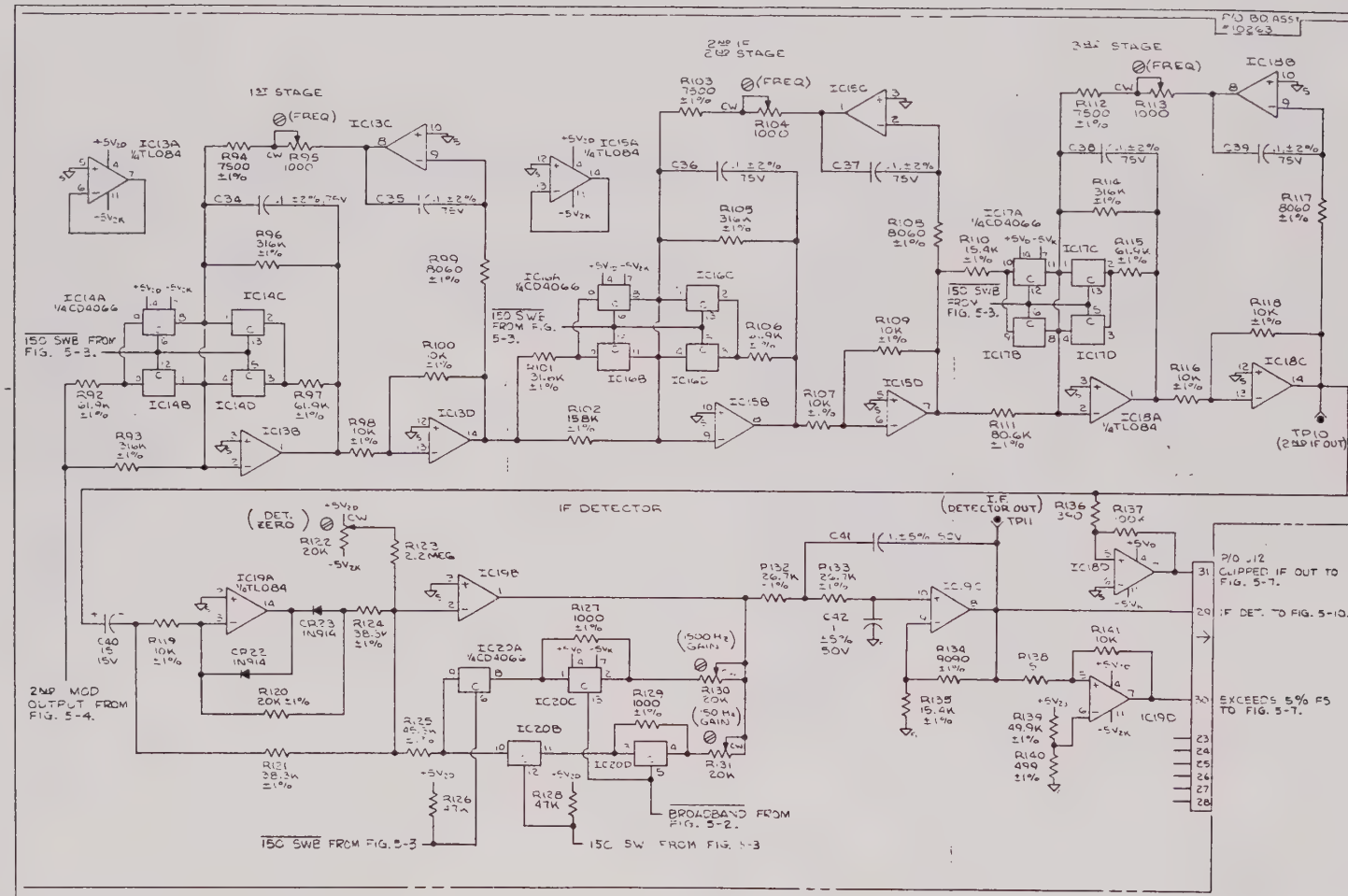


FIGURE 5-5

TITLE: SCHEMATIC, SIGNAL - 2ND IF FILTER, IF DETECTOR			
DRAWN: MJM	DATE: 9-22-81	CODE IDENT NO: 13048	Scientific-Atlanta, Inc. Howard Davis Division, Randolph Park West, Route 10, Randolph, N.J. 07869
CHK: DRZ	APPD:		
MODEL: 2521	SHEET:	SIZE: C	DWG NO: C-10258

TABLE 5-6 REPLACEABLE PARTS LIST

CONTROL - LOAD SEQUENCE, PEN LIFT CONTROL

P/O Control Board Assembly Scientific Atlanta #10265 consisting of:

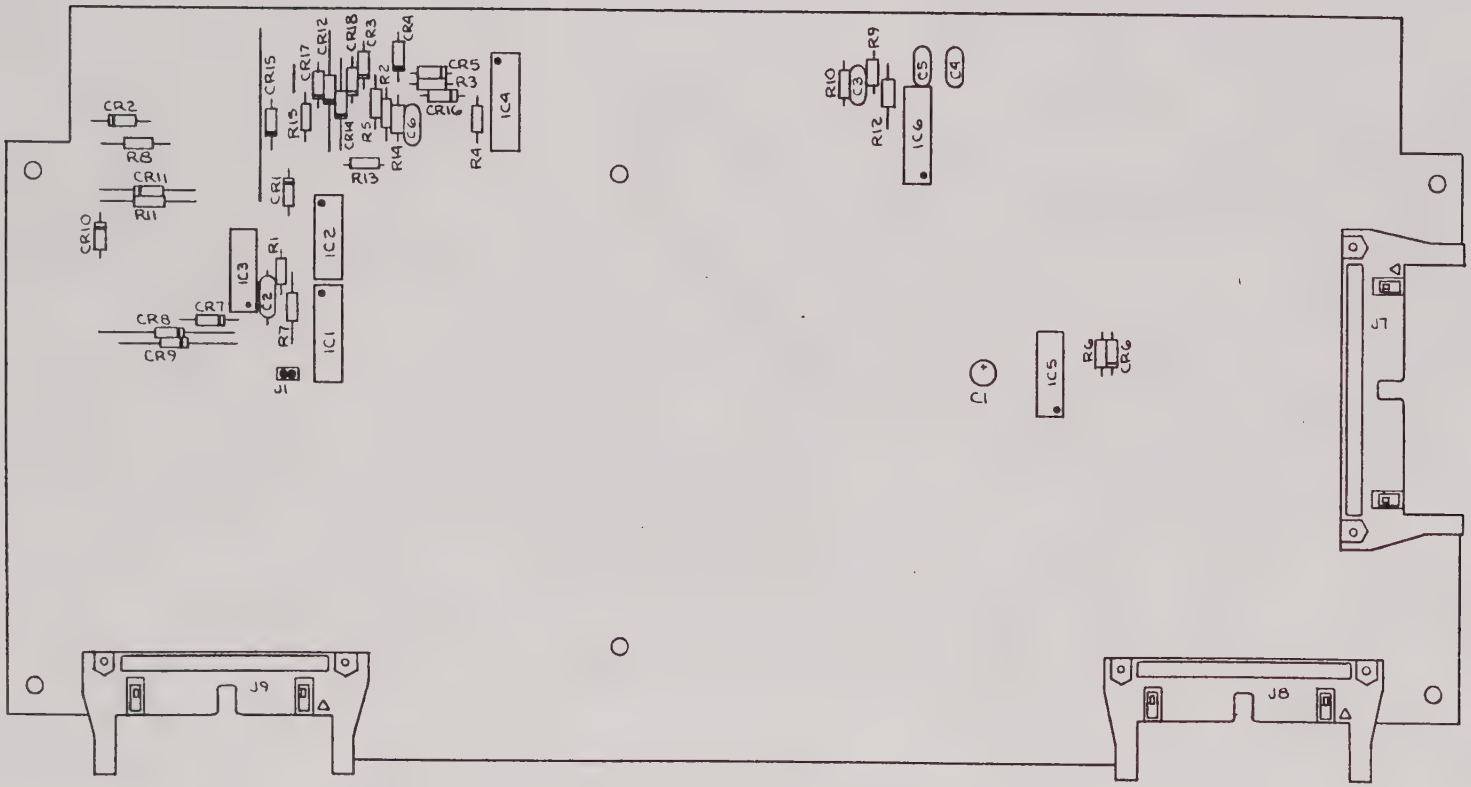
Board, Printed Circuit, Scientific-Atlanta #10266

SYMBOL	DESCRIPTION
C1	Capacitor, 15 mF, 15V, Sprague #196D
C2	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C3	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C4	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C5	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C6	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
CR1	Diode, 1N914
CR2	Diode, 1N914
CR3	Diode, 1N914
CR4	Diode, 1N914
CR5	Diode, 1N914
CR6	Diode, 1N914
CR7	Diode, 1N914
CR8	Diode, 1N914
CR9	Diode, 1N914
CR10	Diode, 1N914
CR11	Diode, 1N914
CR12	Diode, 1N914
CR13	Not Used
CR14	Diode, 1N914
CR15	Diode, 1N914
CR16	Diode, 1N914
CR17	Diode, 1N914
CR18	Diode, 1N914
IC1	Integrated Circuit, CD4015
IC2	Integrated Circuit, CD4001AE
IC3	Integrated Circuit, CD4030
IC4	Integrated Circuit, CD4043
IC5	Integrated Circuit, Scientific-Atlanta A-5662-3
IC6	Integrated Circuit, CD4027
J1	Header, Amp #640456-3
R1	Resistor, 1 MegΩ, ±10%, 1/4W AB Type CB
R2	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R3	Resistor, 10KΩ, ±10%, 1/4W AB Type CB
R4	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R5	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R6	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB

TABLE 5-6 REPLACEABLE PARTS LIST

CONTROL - LOAD SEQUENCE, PEN LIFT CONTROL

SYMBOL	DESCRIPTION
R7	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R8	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R9	Resistor, 1000Ω, ±10%, 1/4W, AB Type CB
R10	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R11	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R12	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R13	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R14	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R15	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB


CR2
R8
CR11
R11
CR10
CR15
CR17
CR12
CR18
CR3
CR4
R2
CR5
R3
CR16
R15
CR14
R5
C6
R14
R13
R4
IC4
CR1
IC2
IC3
C2
R1
R7
CR8
CR7
CR9
IC1
J5
R10
C3
R9
C5
C4
R12
IC6
C1
IC5
R6
CR6
J7
J9
J8

P/O FIGURE 5-6

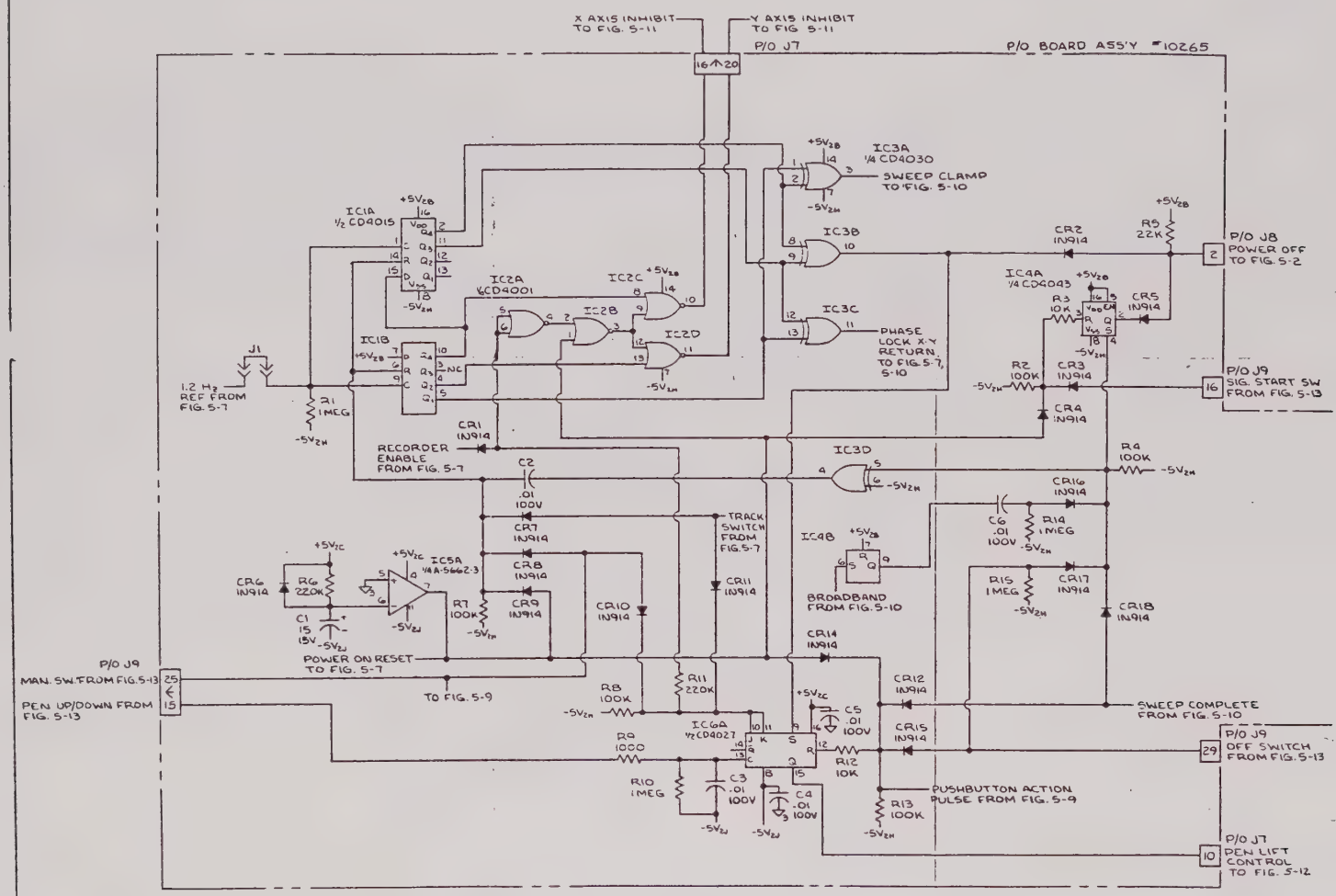


FIGURE 5-6

TITLE: SCHEMATIC CONTROL-LOAD SEQUENCE, PEN LIFT CONTROL			
DRAWN MJM	DATE 9-11-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc. New Jersey Division, Raddington Park West, Route 10, Randolph, N.J. 07869
CHK DRZ	APPD [illegible]		
MODEL 2522	SHEET 1 OF 5	DWG NO C-10259	SIZE A

TABLE 5-7 REPLACEABLE PARTS LIST

CONTROL - VCO, REFRESH, TRACK

P/O Control Board Assembly Scientific-Atlanta #10265 consisting of:

SYMBOL	DESCRIPTION
C7	Capacitor, 470 pF, ±10%, 1KV, CRL #DD-471
C8	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV0220S
C9	Capacitor, 470 pF, ±10%, 1KV, CRL #DD-471
C10	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV0220S
C11	Capacitor, 100 pF, ±10%, 1KV, CRL #DD-101
C12	Capacitor, .1 mF, ±10%, 100V, F-Dyne #MPE-11
C13	Capacitor, .033 mF, ±5%, 100V, F-Dyne #MPE-13
C14	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C15	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV22CS
C16	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV220S
C17	Capacitor, 5 mF, ±5%, 50V, F-Dyne #MPE-13
C18	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C19	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C20	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C21	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C22	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C23	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C24	Capacitor, 2 mF, ±5%, 50V, F-Dyne #MPE-13
C25	Capacitor, 22 mF, 25V, Panasonic #ECEAIVEV220S
C26	Capacitor, 3300 pF, ±5%, 100V, Arco #ADM 19EA-332JN3
C27	Capacitor, 22 mF, 25V, Panasonic #ECEAIEV220S
C28	Capacitor, 100 pF, ±10%, 1KV, CRL #DD-101
CR19	Diode, 1N914
CR20	Diode, 1N914
CR21	Diode, 1N914
CR22	Diode, 1N914
CR23	Diode, 1N914
CR24	Diode, 1N914
CR25	Diode, 1N914
CR26	Diode, 1N914
CR27	Diode, 1N914
CR28	Diode, 1N914
CR29	Diode, 1N914
CR30	Not Used
CR31	Diode, 1N914
IC4	Integrated Circuit, CD4043 (see Table 5-6)
IC6	Integrated Circuit, CD4027 (see Table 5-6)
IC7	Integrated Circuit, CD4013
IC8	Integrated Circuit, CD4066
IC9	Integrated Circuit, Scientific-Atlanta A-5659-2
IC10	Integrated Circuit, Scientific-Atlanta A-5665-2
IC11	Integrated Circuit, CD4518
IC12	Integrated Circuit, CD4020

TABLE 5-7 REPLACEABLE PARTS LIST

CONTROL - VCO, REFRESH, TRACK

SYMBOL	DESCRIPTION
IC13	Integrated Circuit, CD4066
IC14	Integrated Circuit, Scientific-Atlanta A-5659-2
IC15	Integrated Circuit, AD537JH
IC16	Integrated Circuit, CD4066
IC17	Integrated Circuit, CD4013
L1	Coil, Scientific-Atlanta A-10282-2
L2	Coil, Scientific-Atlanta A-10282-2
Q1	Transistor, MPSA18
Q2	Transistor, 2N5953
R16	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R17	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R18	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R19	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R20	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R21	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R22	Resistor, 200KΩ, ±1%, 1/8W
R23	Resistor, 200KΩ, ±1%, 1/8W
R24	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R25	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R26	Resistor, 120KΩ, ±10%, 1/4W, AB Type CB
R27	Resistor, 6.8 MegΩ, ±10%, 1/4W, AB Type CB
R28	Resistor, 10 MegΩ, ±10%, 1/4W, AB Type CB
R29	Resistor, 270Ω, ±10%, 1/4W, AB Type CB
R30	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R31	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R32	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R33	Resistor, 13KΩ, ±1%, 1/8W
R34	Resistor, 10KΩ, ±1%, 1/8W
R35	Resistor, 10KΩ, ±1%, 1/8W
R36	Resistor, 150KΩ, ±10%, 1/4W, AB Type CB
R37	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R38	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R39	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R40	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R41	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R42	Resistor, 243KΩ, ±1%, 1/8 W
R43	Resistor, Variable, 50KΩ, Beckman #68X
R44	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R45	Resistor, 26.7KΩ, ±1%, 1/8W
R46	Resistor, Variable, 500Ω, Beckman #68X
R47	Resistor, 35.7KΩ, ±1%, 1/8W
R48	Resistor, 10 MegΩ, ±10%, 1/4W, AB Type CB

TABLE 5-7 REPLACEABLE PARTS LIST

CONTROL - VCO, REFRESH, TRACK

SYMBOL	DESCRIPTION
R49	Resistor, 15.8KΩ, ±1%, 1/8W
R50	Resistor, 20KΩ, ±1%, 1/8W
R51	Resistor, 1 MegΩ, ±1%, 1/8W
R52	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R53	Resistor, Variable, 10KΩ, Beckman #68X
R54	Resistor, 15.8KΩ, ±1%, 1/8W
R55	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R56	Resistor, 330KΩ, ±10%, 1/4W, AB Type CB
R57	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R58	Resistor, 100Ω, ±1%, 1/8W
R59	Resistor, 100Ω, ±1%, 1/8W
R60	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R61	Resistor, 60.4KΩ, ±1%, 1/8W
R62	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R63	Resistor, 60.4KΩ, ±1%, 1/8W
R64	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R122	Resistor, 15.8KΩ, ±1%, 1/8W

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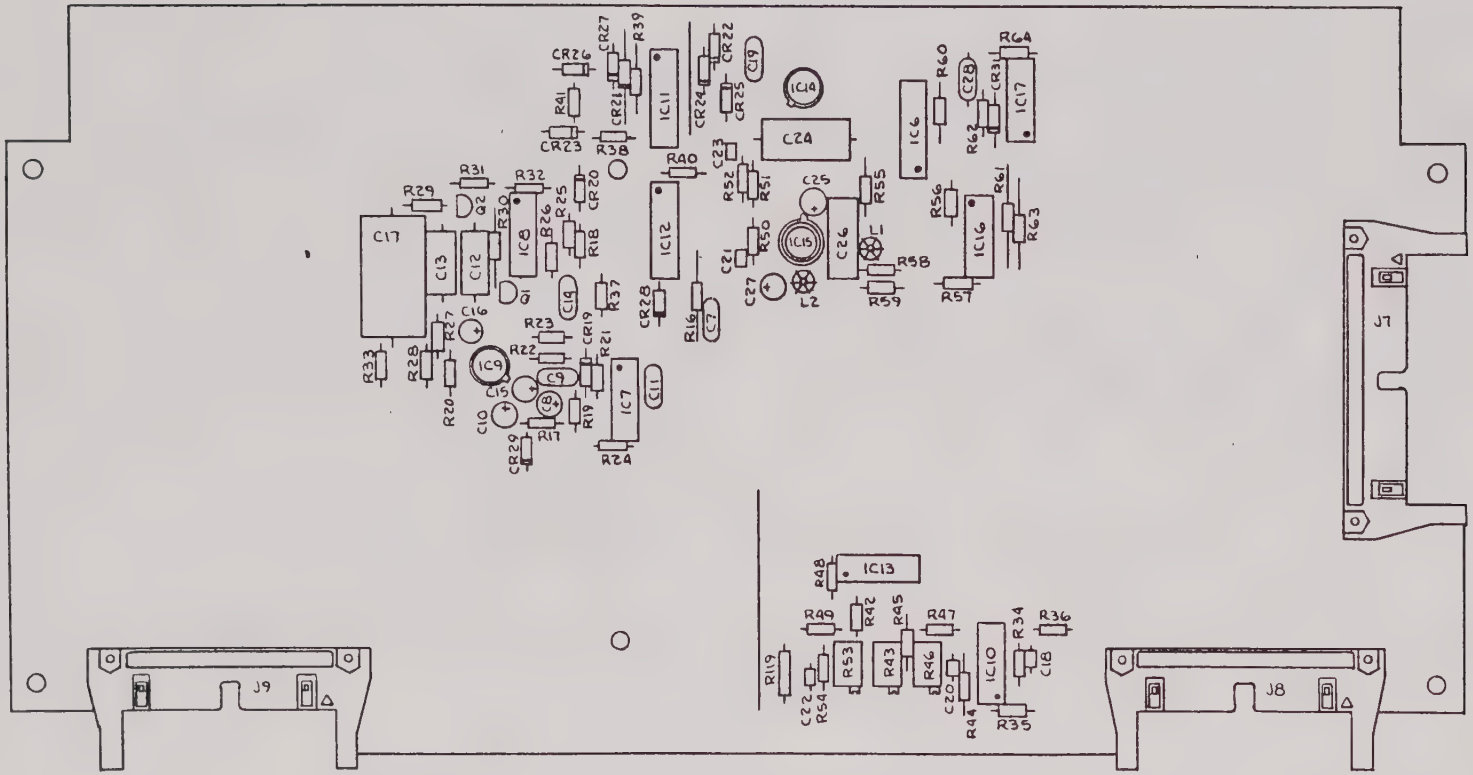

P/O FIGURE 5-7.

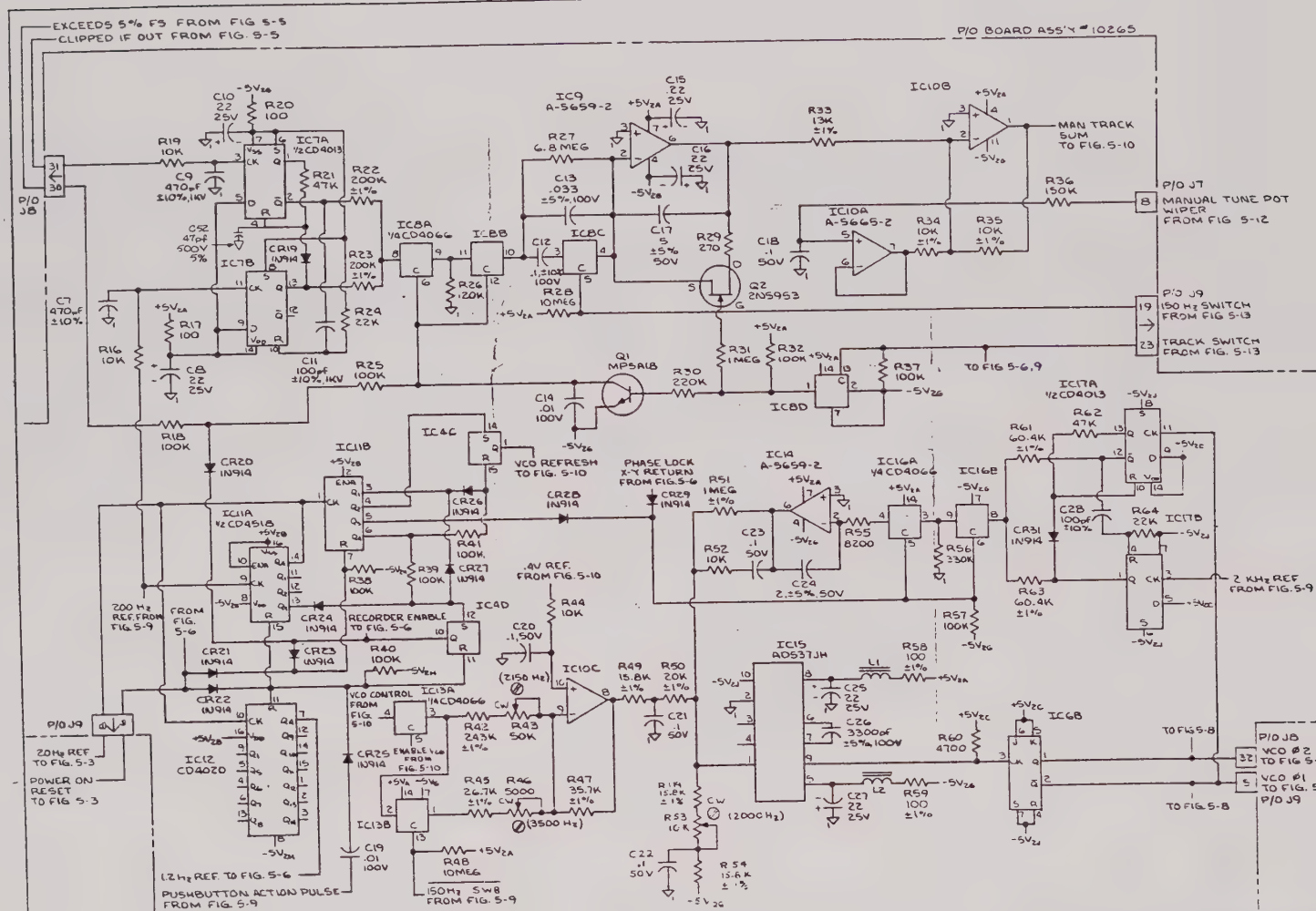
EXCEEDS 5% FS FROM FIG 5-5
CLIPPED IF OUT FROM FIG. 5-5
P/O BOARD ASS'Y # 10265
P/O J8
P/O J9
MAN TRACK SUM TO FIG. 5-10
P/O J7 MANUAL TUNE POT WIPER FROM FIG 5-12
150 Hz SWITCH FROM FIG 5-13
TRACK SWITCH FROM FIG. 5-13
TO FIG 5-6, 9
VCO REFRESH TO FIG. 5-10
PHASE LOCK X-Y RETURN FROM FIG. 5-6
.4V REF. FROM FIG. 5-10
RECORDER ENABLE TO FIG. 5-6
VCO CONTROL FROM FIG. 5-10
CR25 ENABLE VCO FROM FIG. 5-10
200 Hz REF. FROM FIG. 5-9
FROM FIG. 5-6
20 Hz REF TO FIG. 5-3
POWER ON RESET TO FIG 5-3
12 Hz REF. TO FIG. 5-6
PUSHBUTTON ACTION PULSE FROM FIG. 5-9
150 Hz S.W. FROM FIG. 5-9
2 KHz REF FROM FIG. 5-9
P/O J8 VCO #2 TO FIG 5-
P/O J9 VCO #1 TO FIG.
TO FIG 5-8
TO FIG 5-8
(7150 Hz)
(3500 Hz)
(2000 Hz)

FIGURE 5-7

TITLE: SCHEMATIC, CONTROL-VCO, REFRESH, TRACK			
DRAWN MJM	DATE 9-12-81	CODE IDENT NO. 13048	Scientific-Atlanta, I
CHK DRZ	DATE 8-2		
BOARD 2521		SHEET 2 OF 3	DWG NO. C-10259

TABLE 5-8 REPLACEABLE PARTS LIST

CONTROL - STROBE TRIGGER MODULATOR, LP FILTER

P/O Control Board Assembly Scientific Atlanta #10265 consisting of:

SYMBOL	DESCRIPTION
C29	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C30	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C31	Capacitor, 15 mF, 15V, Sprague #196D
C33	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C34	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C35	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C36	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C37	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
C38	Capacitor, .01 mF, ±1%, 50V, Elpac #PD5B-103F
IC5	Integrated Circuit, Scientific-Atlanta A-5662-3 (see Table 5-6)
IC6	Integrated Circuit, CD4027 (see Tables 5-6 & 5-7)
IC18	Integrated Circuit, LM324N
Q3	Transistor, MPSA18
R65	Resistor, 475KΩ, ±1%, 1/8W
R66	Resistor, 402Ω, ±1%, 1/8W
R67	Resistor, 158KΩ, ±1%, 1/8W
R68	Resistor, 10KΩ, ±1%, 1/8W
R69	Resistor, 10KΩ, ±1%, 1/8W
R70	Resistor, 10KΩ, ±1%, 1/8W
R71	Resistor, 10KΩ, ±1%, 1/8W
R72	Resistor, 10KΩ, ±1%, 1/8W
R73	Resistor, 13KΩ, ±1%, 1/8W
R74	Resistor, 30.1KΩ, ±1%, 1/8W
R75	Resistor, 2000Ω, ±1%, 1/8W
R76	Resistor, 13KΩ, ±1%, 1/8W
R77	Resistor, 13KΩ, ±1%, 1/8W
R78	Resistor, 40.2KΩ, ±1%, 1/8W
R79	Resistor, 23.7KΩ, ±1%, 1/8W
R80	Resistor, 13KΩ, ±1%, 1/8W
R81	Resistor, 13KΩ, ±1%, 1/8W
R82	Resistor, 13KΩ, ±1%, 1/8W
R83	Resistor, 38.3KΩ, ±1%, 1/8W
R84	Resistor, 56.2KΩ, ±1%, 1/8W
R85	Resistor, 6800Ω, ±10%, 1/4W, AB Type CB
R86	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R87	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB

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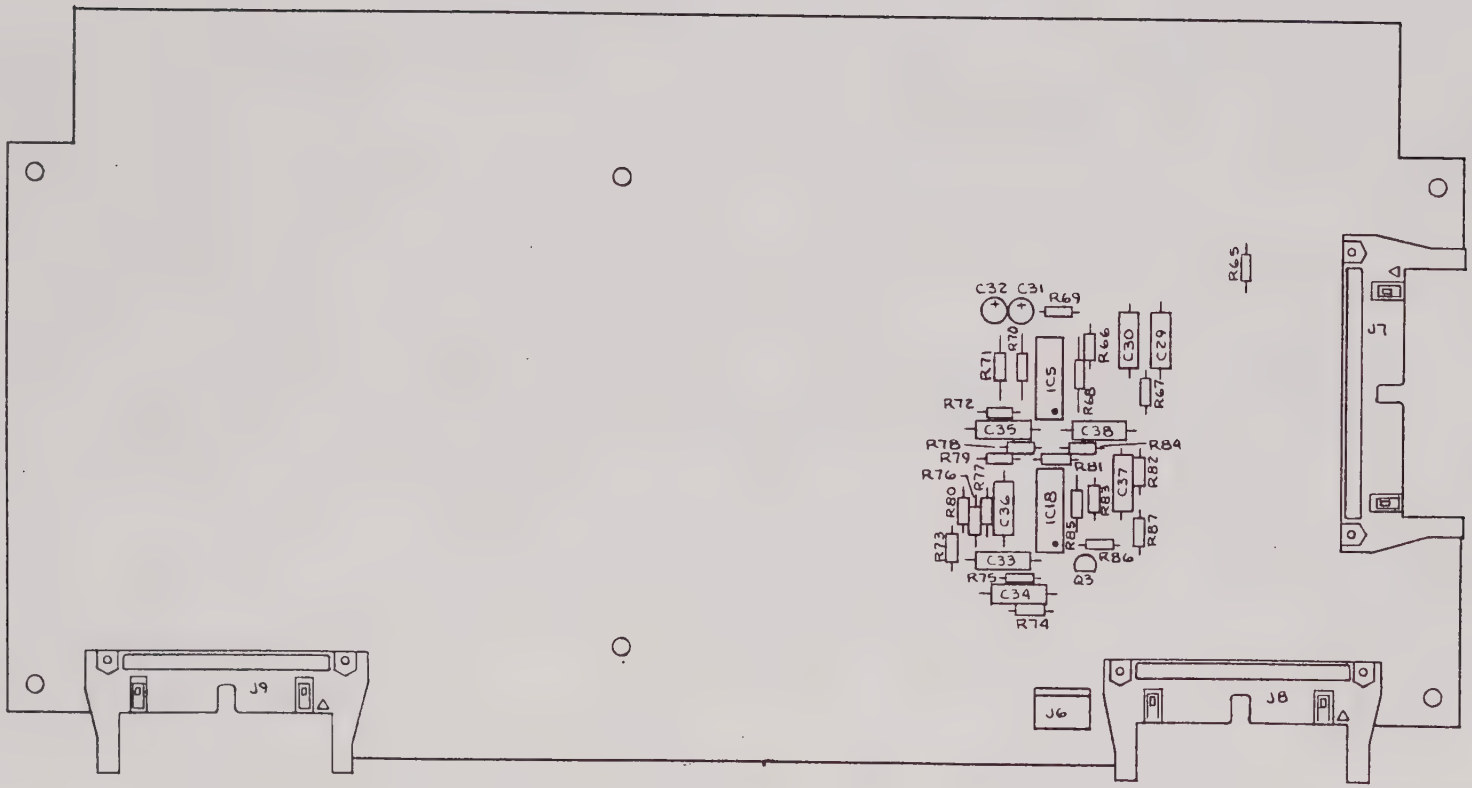
C32
C31
R69
R70
R71
IC5
R66
C30
C29
R68
R67
R72
C35
C38
R78
R84
R79
R81
C37
R82
R76
R77
R80
C36
IC18
R83
R85
R87
R23
C33
R86
Q3
R75
C34
R74
R65
J7
J9
J6
J8

P/O FIGURE 5-8

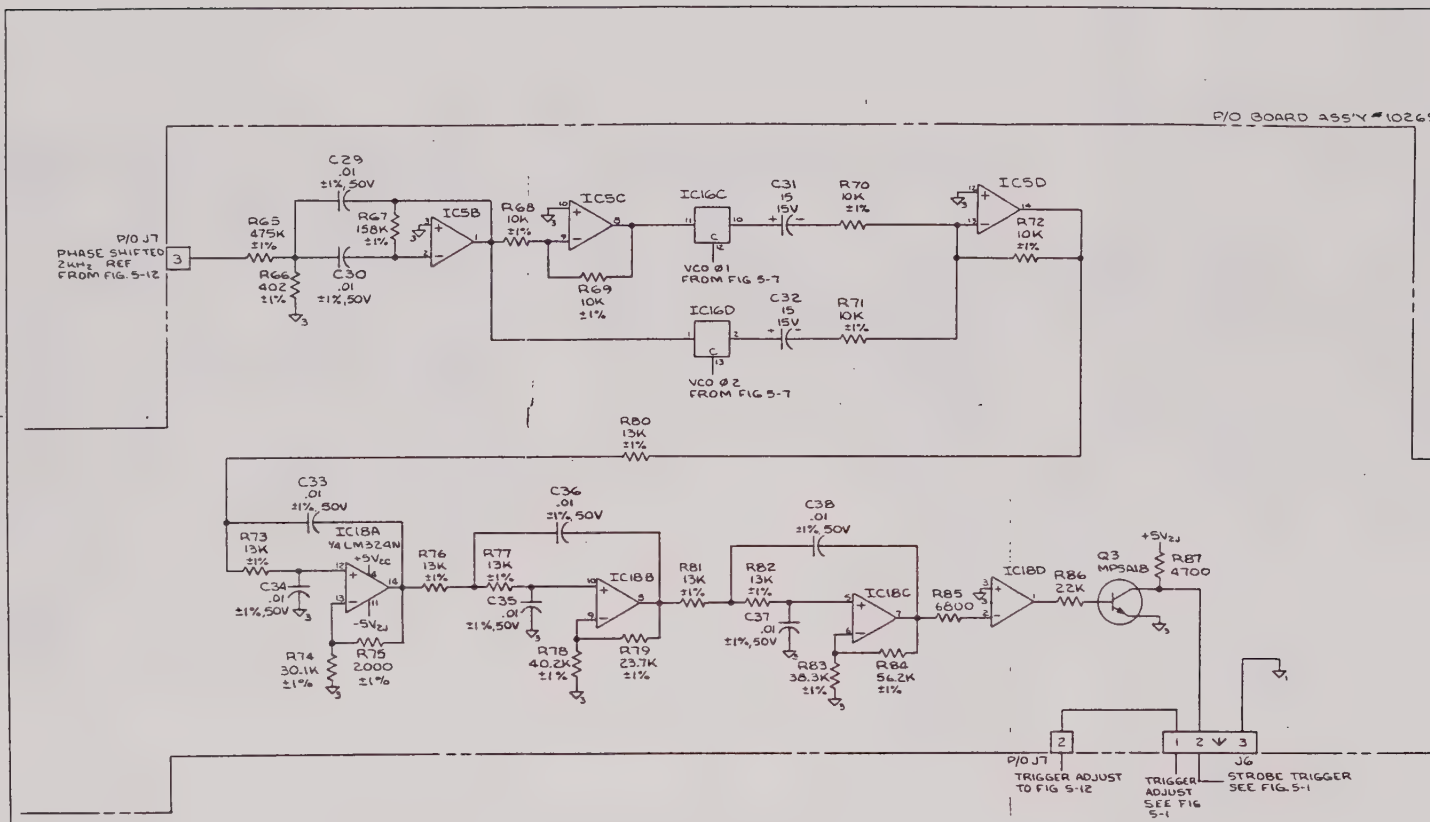

FIGURE 5-8

TITLE: SCHEMATIC, CONTROL-TRIGGER MODULATED LP FILTER, STROBE			
DRAWN: V.V.O	DATE: 9-17-81	CODE IDENT NO. 13048	Scientific-Atlanta, Inc.
CHK: DRZ	APVD: RY		
MODEL: 2521	SHEET	DWG NO. C-10259	REV

TABLE 5-9 REPLACEABLE PARTS LIST

CONTROL - REFERENCE OSCILLATOR, PUSHBUTTON DETECTOR

P/O Control Board Assembly Scientific-Atlanta #10265 consisting of:

SYMBOL	DESCRIPTION
C39	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C40	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C41	Capacitor, 100 pF, ±10%, 1KV, CRL #DD-101
C42	Capacitor, 100 mF, 25V, Panasonic #ECEA1EV101S
C49	Capacitor, 47 pF, ±10%, 1KV, #DD-470
CR32	Diode, 1N914
CR33	Diode, 1N914
CR34	Diode, 1N914
CR35	Diode, 1N914
CR36	Diode, 1N914
CR37	Diode, 1N914
CR38	Diode, 1N914
CR39	Diode, 1N914
CR40	Diode, 1N914
CR41	Diode, 1N914
IC19	Integrated Circuit, CD4042
IC20	Integrated Circuit, CD4042
IC21	Integrated Circuit, CD4030
IC22	Integrated Circuit, CD4030
IC23	Integrated Circuit, CD4047
IC24	Integrated Circuit, CD4518
IC25	Integrated Circuit, CD4013
IC26	Integrated Circuit, CD4518
IC27	Integrated Circuit, CD4013
J7	Header, 3M #3432-1302
J8	Header, 3M #3431-1302
J9	Header, 3M #3431-1302
R88	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R89	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R90	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R91	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R92	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R93	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R119	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R120	Resistor, 3300Ω, ±10%, 1/4W, AB Type CB
R121	Resistor, 33KΩ, ±10%, 1/4W, AB Type CB
TP1	Jack, Test Point, Johnson #105-0572-001
Y1	Crystal, 180 KHz, Bliley #BH96W

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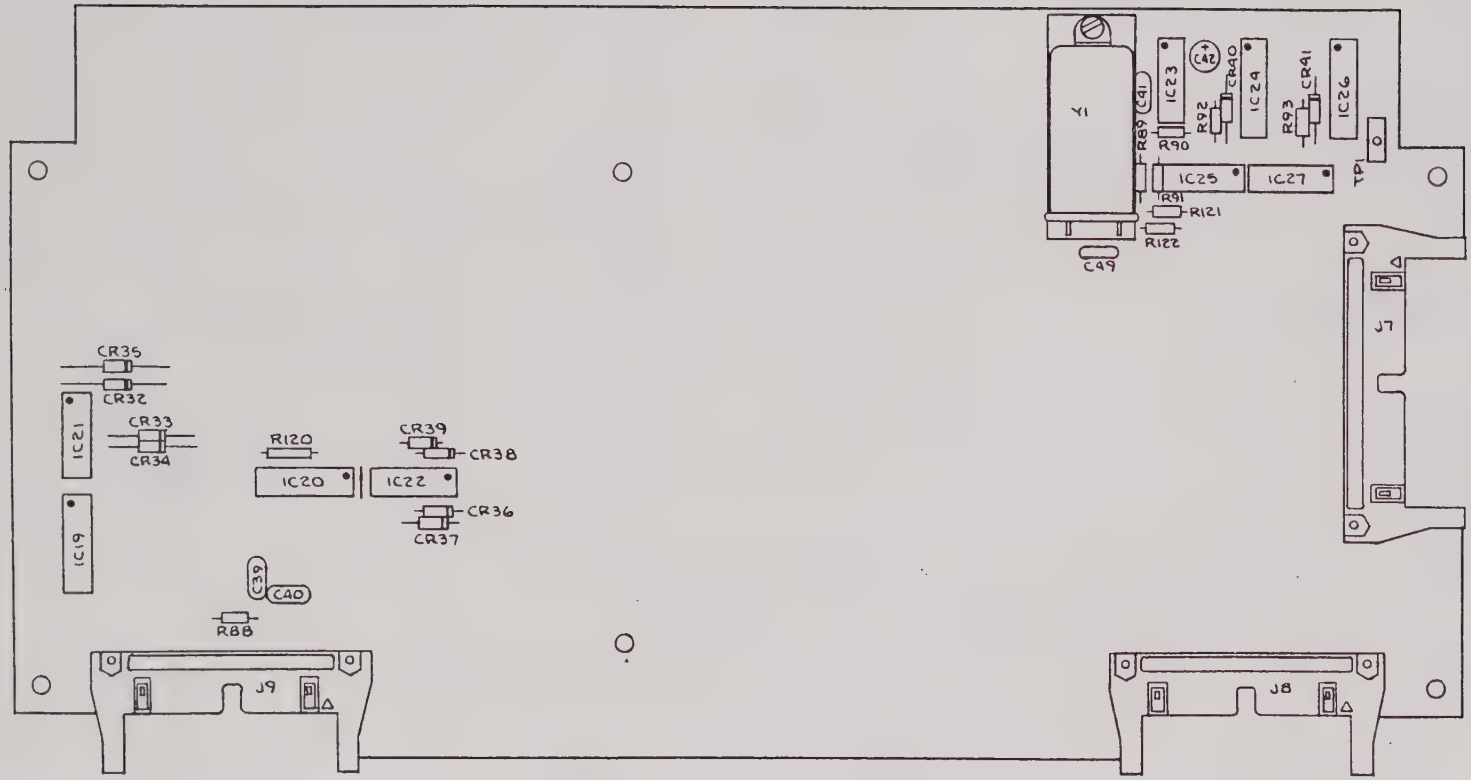

Y1
C41
IC23
C42
CR40
IC24
CR41
IC26
R89
R90
R92
R93
TP1
IC25
IC27
R91
R121
R122
C49
J7
CR35
CR32
IC21
CR33
CR34
R120
CR39
CR38
IC20
IC22
CR36
CR37
IC19
C39
C40
R88
J9
J8

P/O FIGURE 5-9.

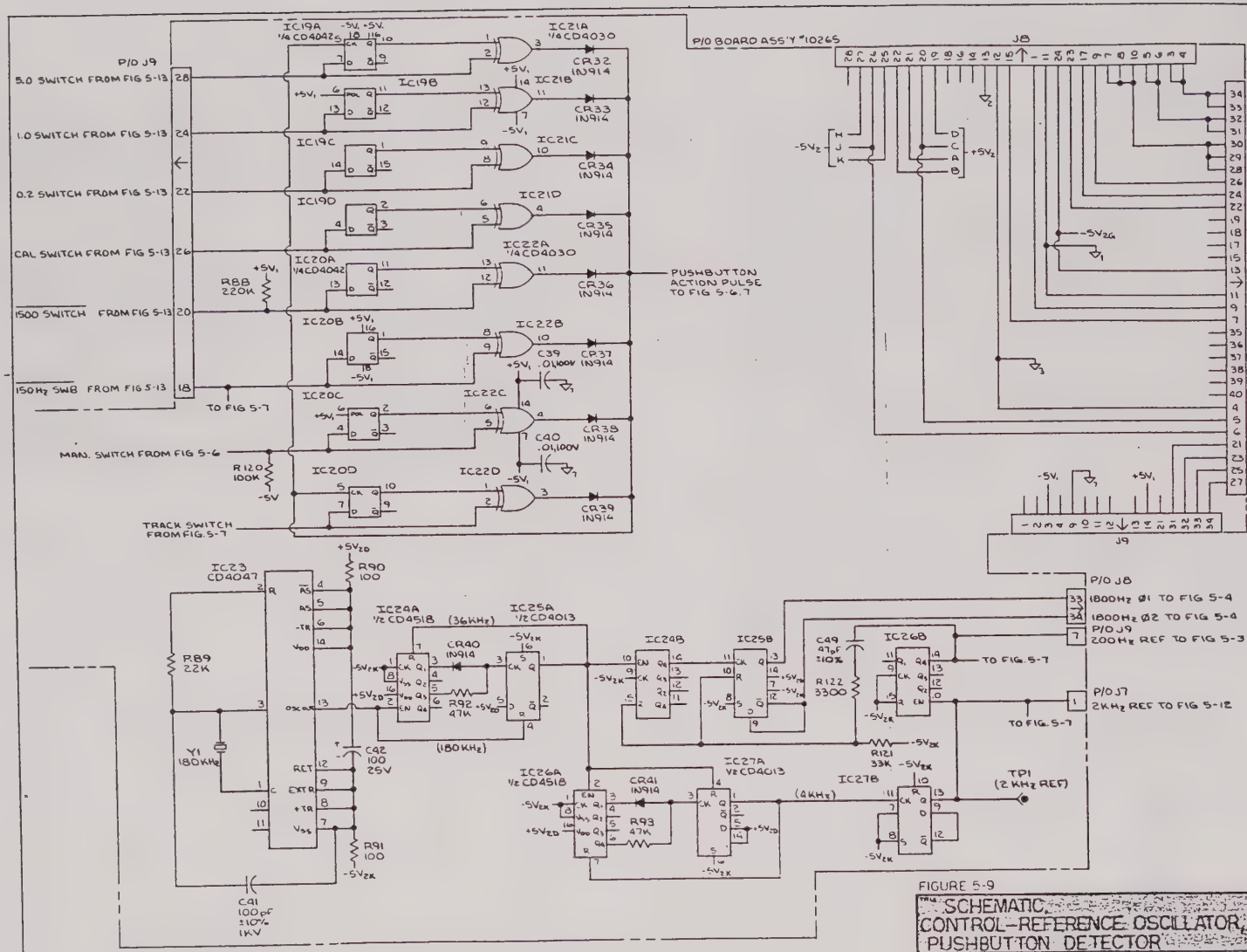


FIGURE 5-9

TITLE: SCHEMATIC, CONTROL-REFERENCE OSCILLATOR, PUSHBUTTON DETECTOR			
DRAWN MJM	DATE 9-23-81	CODE IDENT NO 13048	Scientific-Atlanta, New Jersey Division Randolph Park West, Route 10, Randolph
CHK DRZ	APPD RK		

TABLE 5-10 REPLACEABLE PARTS LIST

CONTROL - SWEEP SEQUENCER, X-Y CONTROL LOGIC

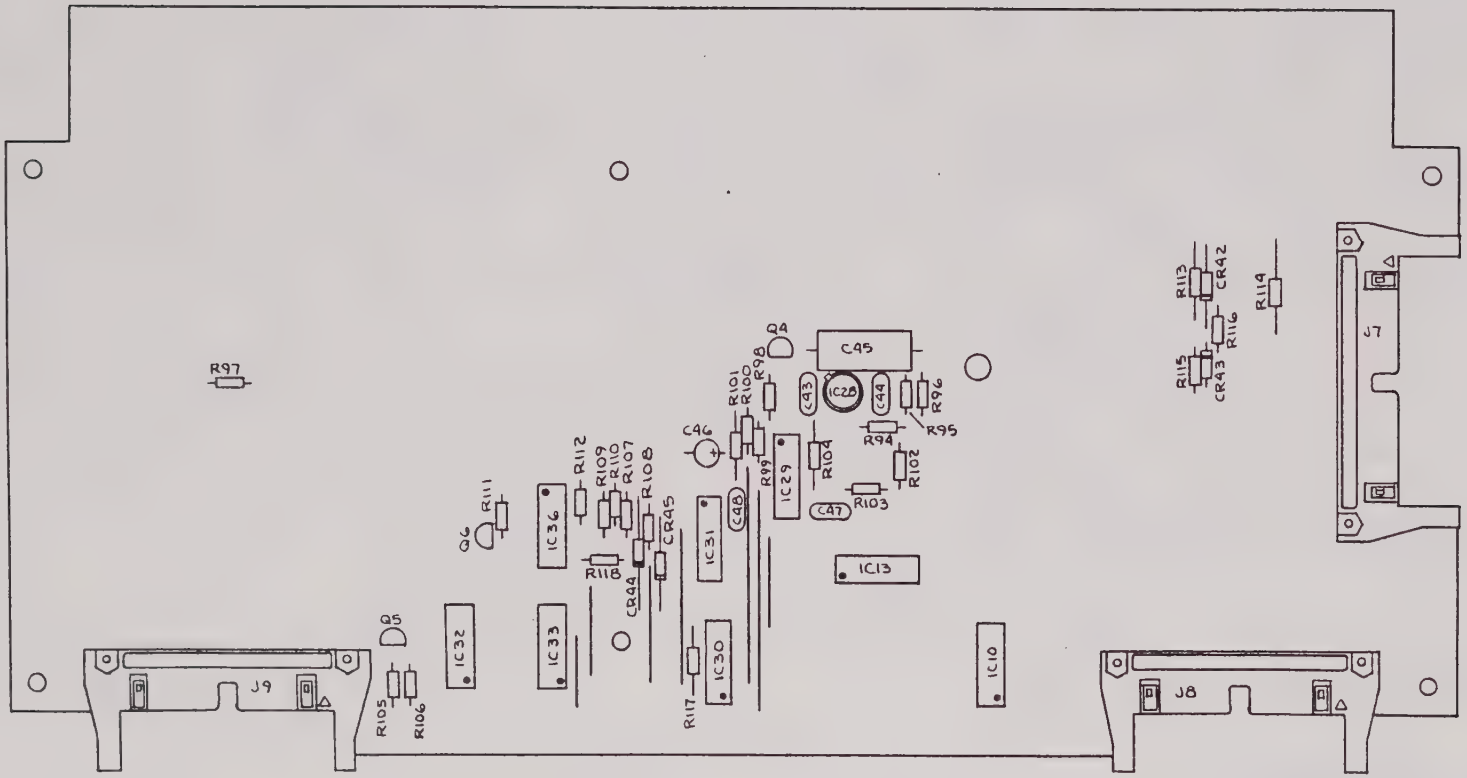
P/O Control Board Assembly Scientific-Atlanta #10265 consisting of:

SYMBOL	DESCRIPTION
C43	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C44	Capacitor, .01 mF, ±20%, 100V, Arco #TCP-R01
C45	Capacitor, 2 mF, ±5%, 50V, F-Dyne #MPE-13
C46	Capacitor, 2.2 mF, ±10%, 25V, Sprague #196D
C47	Capacitor, 200 pF, ±10%, 100V, CRL #DD-201
C48	Capacitor, 470 pF, ±10%, 1KV, CRL #DD-471
CR42	Diode, 1N914
CR43	Diode, 1N914
CR44	Diode, 1N914
CR45	Diode, 1N914
IC10	Integrated Circuit, Scientific-Atlanta A-5665-2 (see Table 5-7)
IC13	Integrated Circuit, CD4066 (see Table 5-7)
IC28	Integrated Circuit, LF356
IC29	Integrated Circuit, LM124
IC30	Integrated Circuit, CD4066
IC31	Integrated Circuit, CD4030
IC32	Integrated Circuit, CD4071
IC33	Integrated Circuit, CD4081
IC34	Not Used
IC35	Not Used
IC36	Integrated Circuit, CD4066
R94	Resistor, 31.6KΩ, ±1%, 1/8W
R95	Resistor, 9090Ω, ±1%, 1/8W
R96	Resistor, 10 MegΩ, ±1%, 1/8W
R97	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R98	Resistor, 2000Ω, ±1%, 1/8W
R99	Resistor, 18.2KΩ, ±1%, 1/8W
R100	Resistor, 20KΩ, ±1%, 1/8W
R101	Resistor, 6040Ω, ±1%, 1/8W
R102	Resistor, 2000Ω, ±1%, 1/8W
R103	Resistor, 1000Ω, ±1%, 1/8W
R104	Resistor, 1000Ω, ±1%, 1/8W
R105	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R106	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R107	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R108	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R109	Resistor, 20KΩ, ±1%, 1/8W
R110	Resistor, 1000Ω, ±1%, 1/8W
R111	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R112	Resistor, 715Ω, ±1%, 1/8W
R113	Resistor, 20KΩ, ±1%, 1/8W
R114	Resistor, 10KΩ, ±1%, 1/8W
R115	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB

TABLE 5-10 REPLACEABLE PARTS LIST

CONTROL - SWEEP SEQUENCER, X-Y CONTROL LOGIC

SYMBOL	DESCRIPTION
R116	Resistor, 3300Ω, ±10%, 1/4W, AB Type CB
R117	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R118	Resistor, 316KΩ, ±1%, 1/8W
Q4	Transistor, 2N5953
Q5	Transistor, MPSA18
Q6	Transistor, MPSA18



P/O FIGURE 5-10.

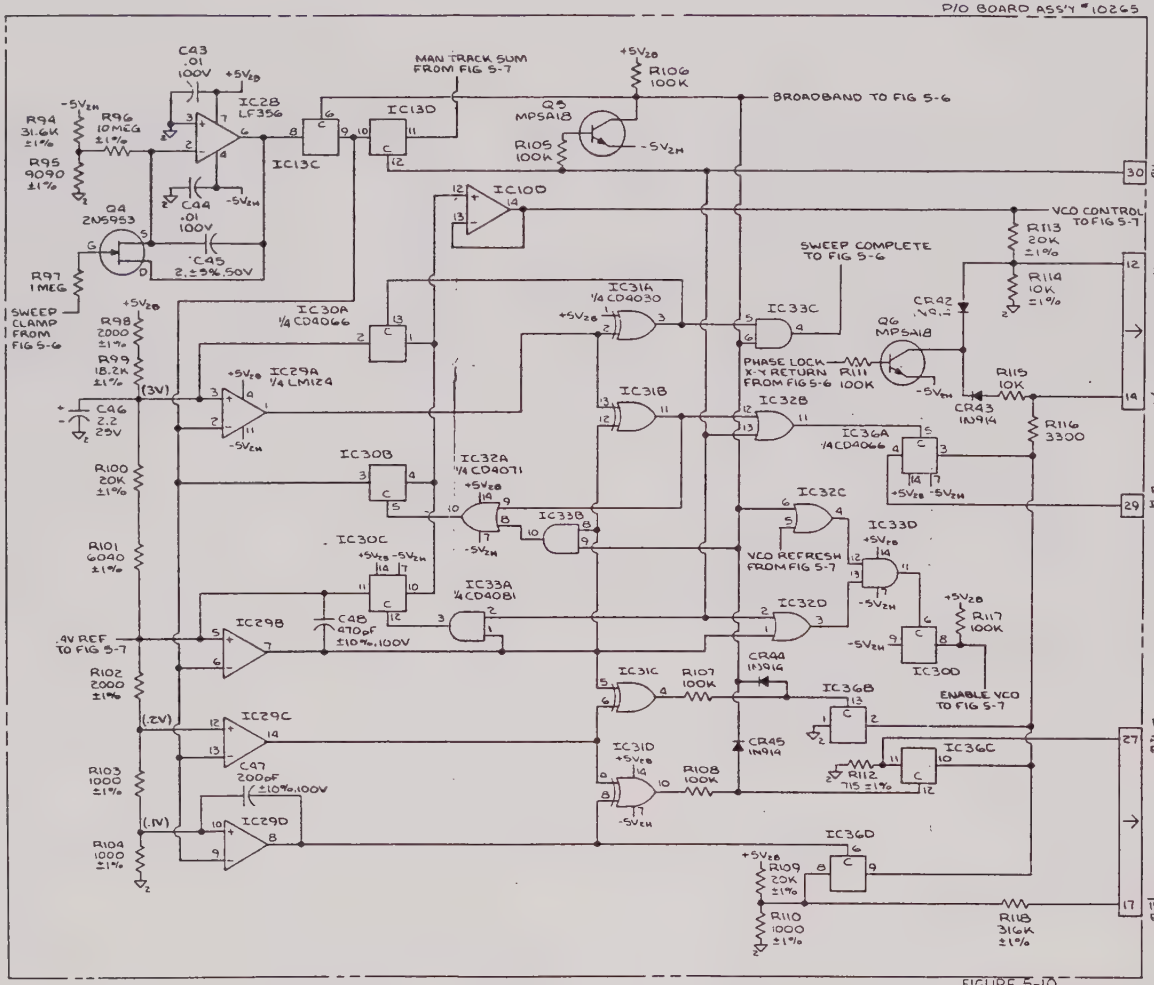


FIGURE 5-10

TITLE: SCHEMATIC, CONTROL-SWEEP SEQUENCER CONTROL LOGIC			
DRAWN MJM	DATE 9-24-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc. Atlanta Georgia Division Randolph Park West, Route 10, Randolph, N.J. 07869
CHK DRZ	APPD RV		
MODEL	SHEET 1	PART NO C-1025-075	SIZE

TABLE 5-11 REPLACEABLE PARTS LIST

X-Y RECORDER - X-Y MOTOR DRIVE

P/O Recorder Board Assembly Scientific-Atlanta #10267 consisting of:

Board, Printed Circuit, Scientific-Atlanta #10268

SYMBOL	DESCRIPTION
C1	Capacitor, 330 pF, ±5%, 500V, Arco #ADM19ED331J03
C2	Capacitor, .5 mF, ±20%, 50V, F-Dyne #MPE-13
C3	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C4	Capacitor, 330 pF, ±5%, 500V, Arco #ADM19ED331J03
C5	Capacitor, .5 mF, ±20%, 50V, F-Dyne #MPE-13
C6	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
CR1	Diode, IN4151
CR2	Diode, IN4151
CR3	Diode, 1N914
CR4	Diode, 1N914
CR5	Diode, 1N914
CR6	Diode, 1N914
IC1	Integrated Circuit, LM324N
IC2	Integrated Circuit, MC4741CP
IC3	Integrated Circuit, LM324N
Q1	Transistor, MPSA18
Q2	Transistor, TIP 32
Q3	Transistor, 2N3644
Q4	Transistor, TIP 31
Q5	Transistor, MPSA18
Q6	Transistor, MPSA18
Q7	Transistor, MPSA18
Q8	Transistor, 2N3644
Q9	Transistor, TIP 32
Q10	Transistor, TIP 31
Q11	Transistor, TIP 31
Q12	Transistor, 2N3644
R1	Resistor, 10KΩ, ±1%, 1/8W
R2	Resistor, 18.2KΩ, ±1%, 1/8W
R3	Resistor, 18.2KΩ, ±1%, 1/8W
R4	Resistor, Variable, 5000Ω, Beckman #72XW
R5	Resistor, 27.4KΩ, ±1%, 1/8W
R6	Resistor, 470Ω, ±10%, 1/4W, AB Type CB
R7	Resistor, Variable, 5000Ω, Beckman #72XW
R8	Resistor, 30.1KΩ, ±1%, 1/8W
R9	Resistor, 1470Ω, ±1%, 1/8W
R10	Resistor, 49.9KΩ, ±1%, 1/8W

TABLE 5-11 REPLACEABLE PARTS LIST

X-Y RECORDER - X-Y MOTOR DRIVE

SYMBOL	DESCRIPTION
R11	Resistor, 49.9KΩ, ±1%, 1/8W
R12	Resistor, 7500Ω, ±1%, 1/8W
R13	Resistor, Variable, 1000Ω, Beckman #72XW
R14	Resistor, 1620Ω, ±1%, 1/8W
R15	Resistor, 499KΩ, ±1%, 1/8W
R16	Resistor, 49.9KΩ, ±1%, 1/8W
R17	Resistor, 15KΩ, ±10%, 1/4W, AB Type CB
R18	Resistor, 39KΩ, ±10%, 1/4W, AB Type CB
R19	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R20	Resistor, 1500Ω, ±10%, 1/4W, AB Type CB
R21	Resistor, 5600Ω, ±10%, 1/4W, AB Type CB
R22	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R23	Resistor, 100Ω, ±10%, 1/2W, AB Type EB
R24	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R25	Resistor, 33Ω, ±10%, 1/4W, AB Type CB
R26	Resistor, 100Ω, ±10%, 1/2W, AB Type EB
R27	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R28	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R29	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R30	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R31	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R32	Resistor, 10KΩ, ±1%, 1/8W
R33	Resistor, 18.2KΩ, ±1%, 1/8W
R34	Resistor, 18.2KΩ, ±1%, 1/8W
R35	Resistor, Variable, 5000Ω, Beckman #72XW
R36	Resistor, 27.4KΩ, ±1%, 1/8W
R37	Resistor, 470Ω, ±10%, 1/4, AB Type CB
R38	Resistor, Variable, 5000Ω, Beckman #72XW
R39	Resistor, 49.9KΩ, ±1%, 1/8W
R40	Resistor, 316Ω, ±1%, 1/8W
R41	Resistor, 49.9KΩ, ±1%, 1/8W
R42	Resistor, 49.9KΩ, ±1%, 1/8W
R43	Resistor, 7500Ω, ±1%, 1/8W
R44	Resistor, Variable, 1000Ω, Beckman #72XW
R45	Resistor, 1620Ω, ±1%, 1/8W
R46	Resistor, 499KΩ, ±1%, 1/8W
R47	Resistor, 49.9KΩ, ±1%, 1/8W
R48	Resistor, 15KΩ, ±10%, 1/4W, AB Type CB
R49	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R50	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R51	Resistor, 5600Ω, ±10%, 1/4W, AB Type CB
R52	Resistor, 1500Ω, ±10%, 1/4W, AB Type CB
R53	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R54	Resistor, 100Ω, ±10%, 1/2W, AB Type EB
R55	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R56	Resistor, 33Ω, ±10%, 1/4W, AB Type CB

TABLE 5-11 REPLACEABLE PARTS LIST

X-Y RECORDER - X-Y MOTOR DRIVE

SYMBOL	DESCRIPTION
R57	Resistor, 100Ω, ±10%, 1/2W, AB Type EB
R58	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R59	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R60	Resistor, 470Ω, ±10%, 1/4W, AB Type CB
R61	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
TP1	Jack, Test Point, Johnson #105-0752-001
TP2	Jack, Test Point, Johnson #105-0752-001
TP3	Jack, Test Point, Johnson #105-0752-001
TP4	Jack, Test Point, Johnson #105-0752-001
TP5	Jack, Test Point, Johnson #105-0752-001

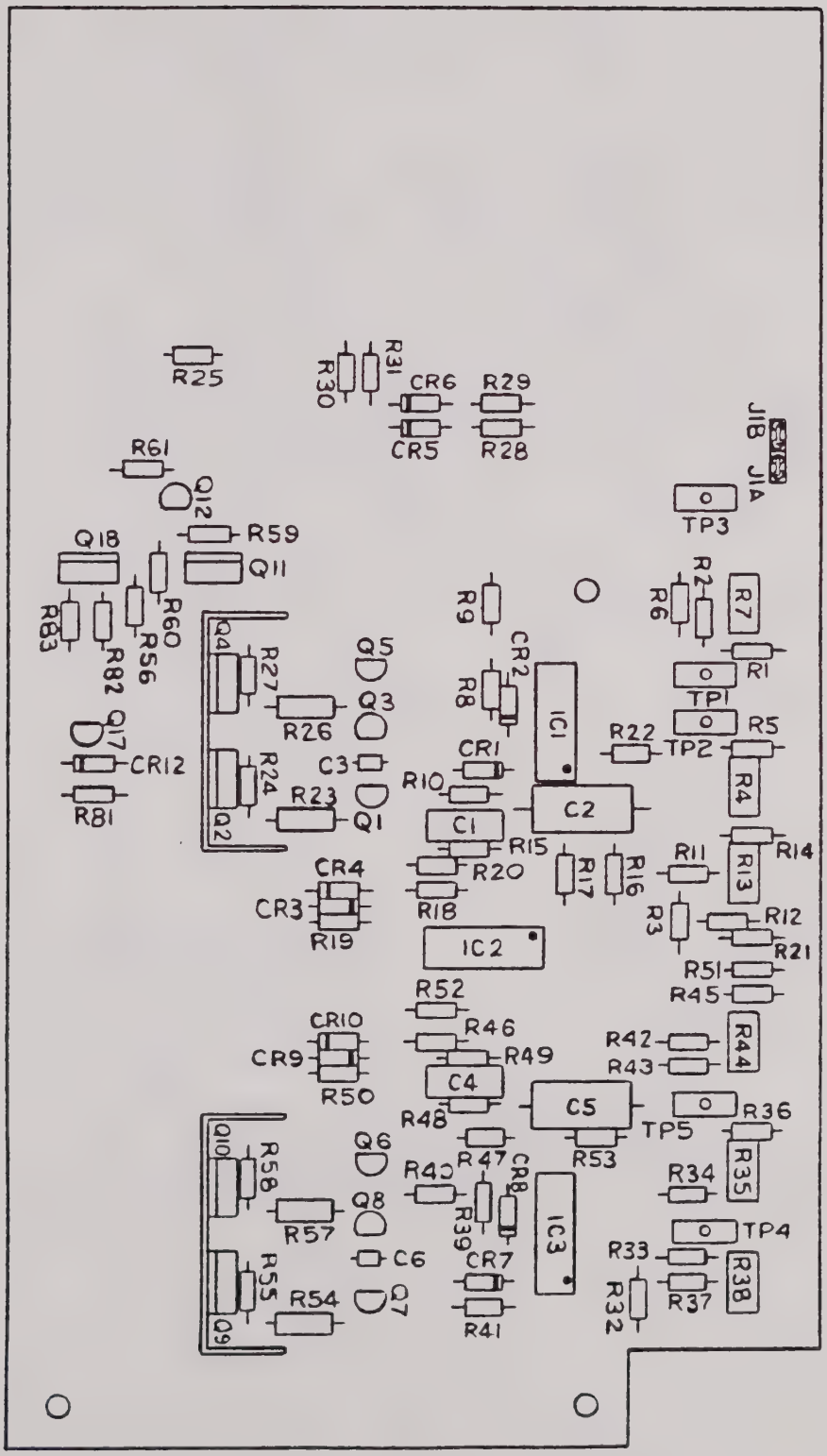

R25
R31
R30
CR6
R29
CR5
R28
J1B
J1A
R61
Q12
TP3
R59
Q18
Q11
R9
R2
R6
R7
R60
R83
R82
R56
Q4
R27
Q5
CR2
R8
R1
TP1
Q3
R26
IC1
R22
TP2
R5
Q17
CR12
C3
CR1
R10
R24
R23
Q1
C2
R4
R81
Q2
C1
R15
R14
R11
R13
CR4
R20
R17
R16
CR3
R18
R3
R12
R19
IC2
R21
R51
R52
R45
CR10
R46
R42
R44
CR9
R49
R43
C4
R50
C5
R36
R48
TP5
R53
Q10
R58
Q6
R47
CR8
R34
R35
R57
Q8
R40
R39
IC3
TP4
C6
CR7
R33
R38
R55
R54
Q7
R37
R32
Q9
R41

Figure 5-11.

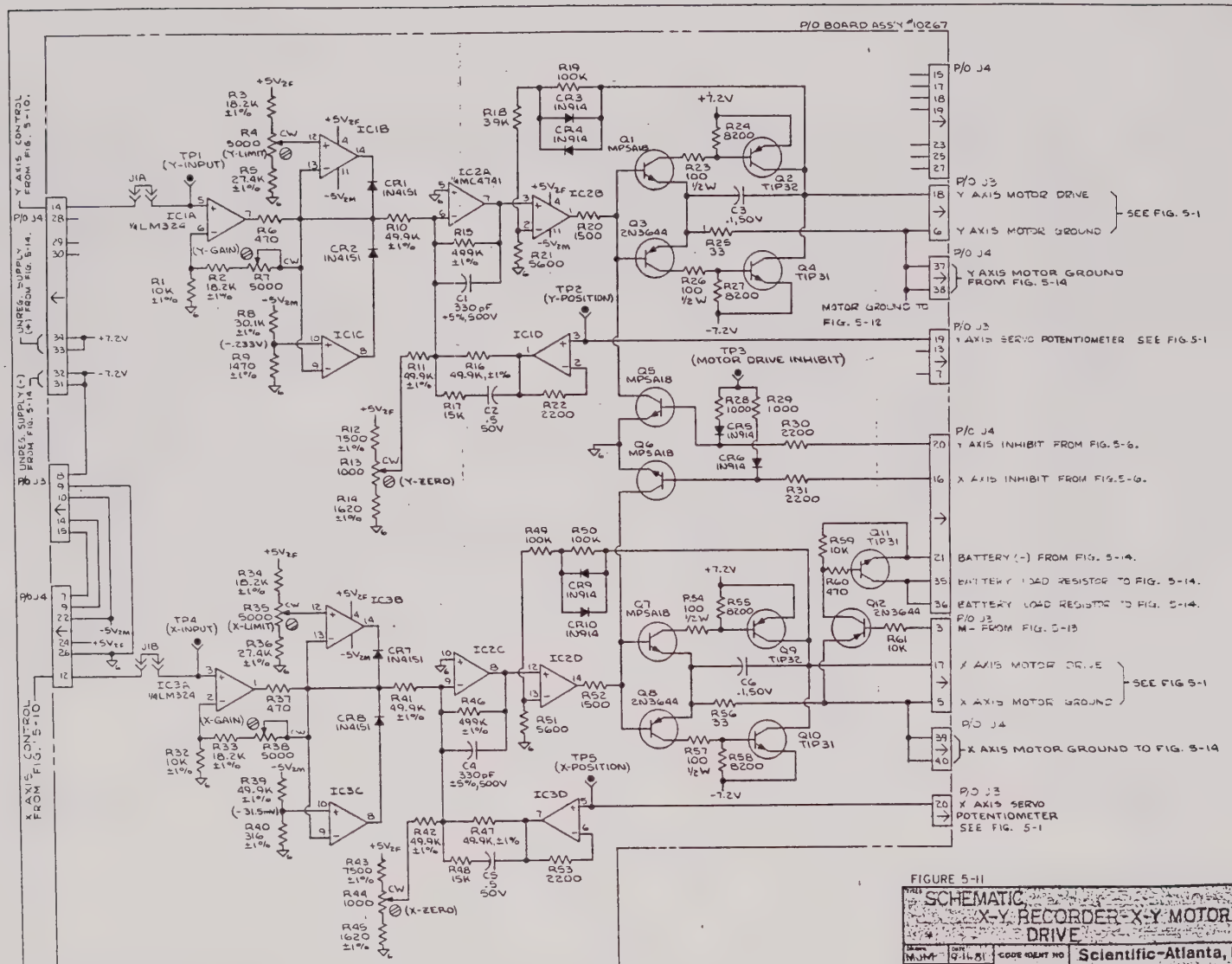


FIGURE 5-11

SCHEMATIC X-Y RECORDER-X-Y MOTOR DRIVE			
Drawn MJM	Date 9-16-81	Code Ident No 13048	Scientific-Atlanta,
Com DRZ	Appd 9/16		New Jersey Division Research Park West, Monroe NJ, Blandford,

TABLE 5-12 REPLACEABLE PARTS LIST

X-Y RECORDER - PHASE SHIFTER, PEN LIFT DRIVE

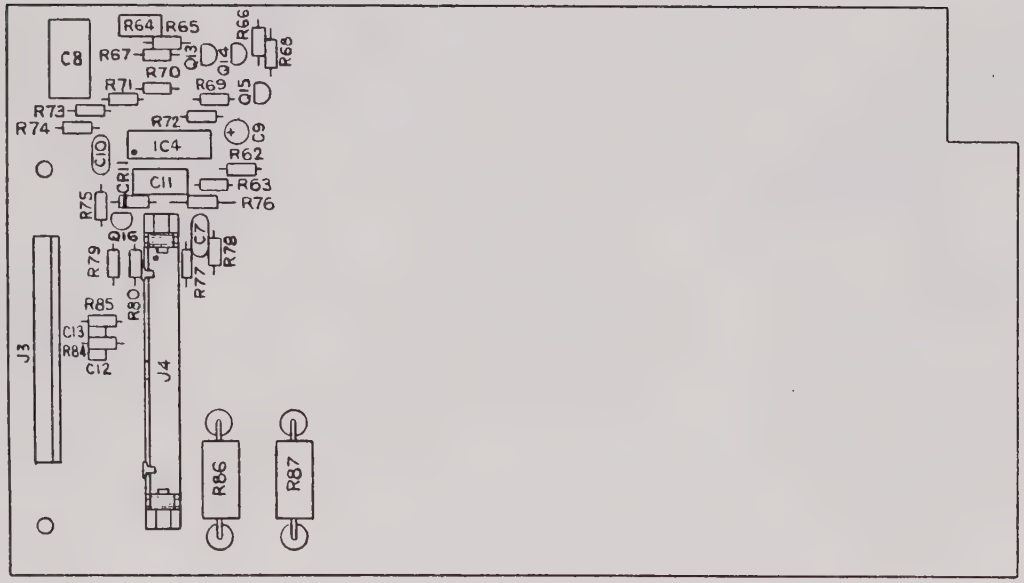
P/O Recorder Board Assembly Scientific-Atlanta #10267 consisting of:

SYMBOL	DESCRIPTION
C7	Capacitor, 470 pF, ±10%, 1KV, CRL #DD-471
C8	Capacitor, .0047 mF, ±1%, Electrocube #230DIB472F
C9	Capacitor, 2.2 mF, 25V, Sprague #196D225X9025HAI
C10	Capacitor, 47 pF, ±10%, 1KV, CRL #DD-470
C11	Capacitor, .001 mF, ±1%, 100V, Arco #DM-15
C12	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
C13	Capacitor, .1 mF, ±20%, 50V, Arco #200-050-Z5U-104
CR7	Diode, 1N4151
CR8	Diode, 1N4151
CR9	Diode, 1N914
CR10	Diode, 1N914
CR11	Diode, 1N914
CR12	Diode, 1N914
IC4	Integrated Circuit, LM239
J3	Header, Amp #2-640456-0
J4	Header, 3M #3432-2302
Q13	Transistor, 2N3644
Q14	Transistor, 2N3644
Q15	Transistor, 2N3644
Q16	Transistor, MPSA18
Q17	Transistor, MPSA18
Q18	Transistor, TIP 32
R62	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R63	Resistor, 2200Ω, ±10%, 1/4W, AB Type CB
R64	Resistor, Variable, 500Ω, Beckman #72XW
R65	Resistor, 4750Ω, ±1%, 1/8W
R66	Resistor, 316Ω, ±1%, 1/8W
R67	Resistor, 9090Ω, ±1%, 1/8W
R68	Resistor, 316Ω, ±1%, 1/8W
R69	Resistor, 100KΩ, ±1%, 1/8W
R70	Resistor, 301KΩ, ±1%, 1/8W
R71	Resistor, 301KΩ, ±1%, 1/8W
R72	Resistor, 301KΩ, ±1%, 1/8W
R73	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R74	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R75	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R76	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R77	Resistor, 402KΩ, ±1%, 1/8W
R78	Resistor, 200KΩ, ±1%, 1/8W

TABLE 5-12 REPLACEABLE PARTS LIST

X-Y RECORDER - PHASE SHIFTER, PEN LIFT DRIVE

SYMBOL	DESCRIPTION
R79	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R80	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R81	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R82	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R83	Resistor, 330Ω, ±10%, 1/4W, AB Type CB
R84	Resistor, 6190Ω, ±1%, 1/8W
R85	Resistor, 750Ω, ±1%, 1/8W
R86	Resistor, 220Ω, ±10%, 2W, AB Type HB
R87	Resistor, 220Ω, ±10%, 2W, AB Type HB



P/O FIGURE 5-12.

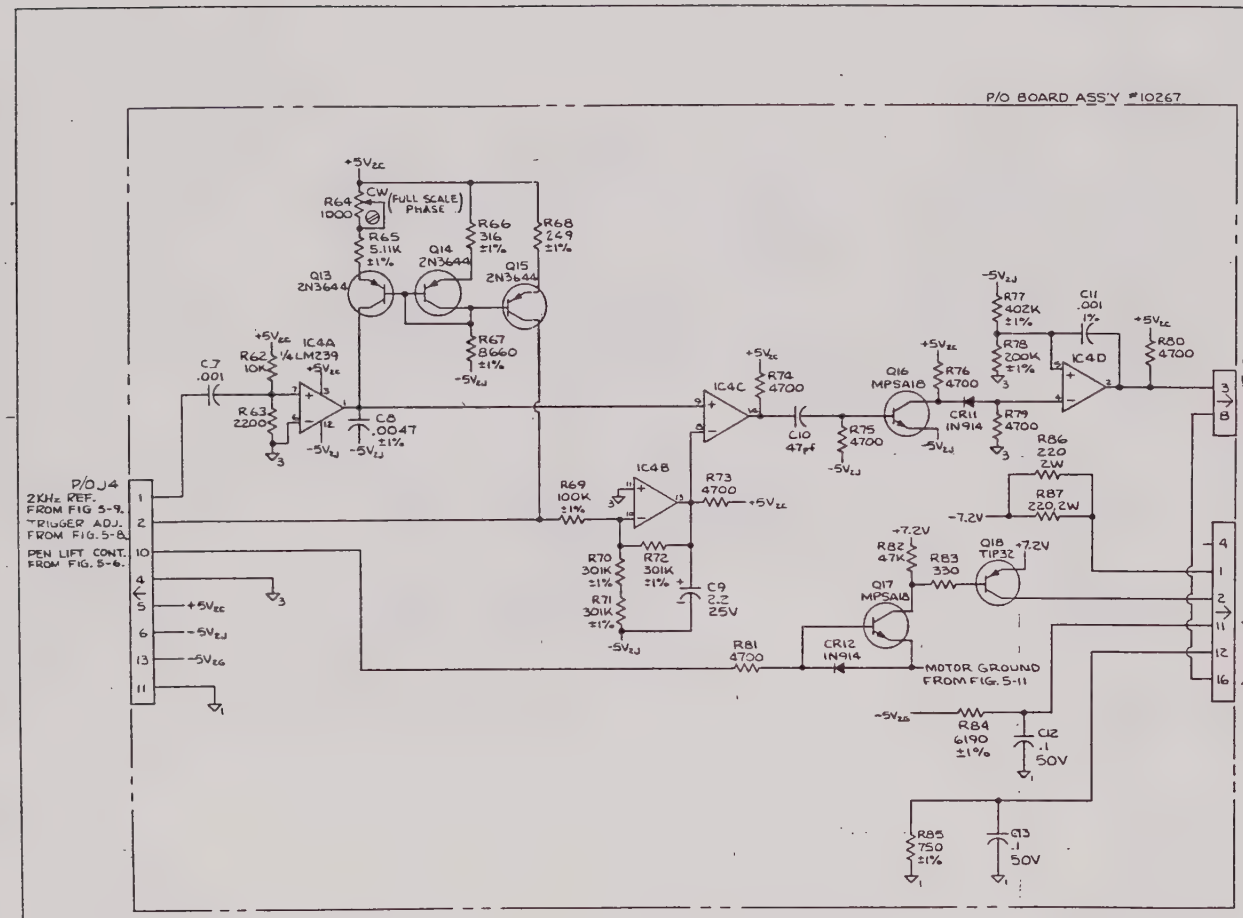


FIGURE 5-12

SCHEMATIC, X-Y RECORDER - PHASE SHIFTER PEN LIFT DRIVER

DRAWING NO. 1100	DATE 9-11-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc.
DRAWN BY	CHECKED BY		

TABLE 5-13 REPLACEABLE PARTS LIST

PANEL

Panel Board Assembly Scientific-Atlanta #10271 consisting of:

SYMBOL	DESCRIPTION
J1	Header, AMP #640456-3
J10	Header, 3M #3429-1302
LED1	Lamp, Chicago-Miniature #CM4-83
LED2	Lamp, Chicago-Miniature #CM4-83
R1	Resistor, 40.2KΩ, ±1%, 1/8W
R2	Resistor, 1430Ω, ±1%, 1/8W
R3	Resistor, 10KΩ, ±1%, 1/8W
R4	Resistor, 49.9KΩ, ±1%, 1/8W
S1	Switch, Scientific-Atlanta A-10333-1
S2	Switch, Scientific-Atlanta A-10333-1
S3	Switch, Scientific-Atlanta A-10333-1
S4	Switch, Scientific-Atlanta A-10333-4
S5	Switch, Scientific-Atlanta A-10333-4
S6	Switch, Scientific-Atlanta A-10333-4
S7	Switch, Scientific-Atlanta A-10333-4
S8	Switch, Scientific-Atlanta A-10333-1
S9	Switch, Scientific-Atlanta A-10333-2
S10	Switch, Scientific-Atlanta A-10333-2
S11	Switch, Scientific-Atlanta A-10333-3
S12	Switch, Scientific-Atlanta A-10333-3
S13	Switch, Scientific-Atlanta A-10333-3

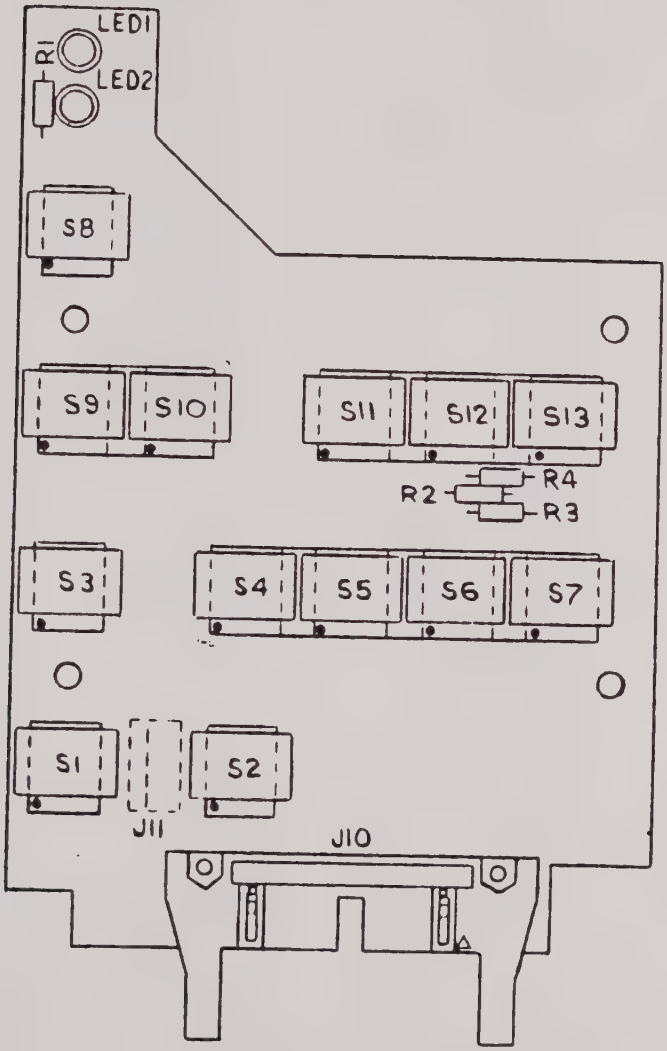

LED1
R1
LED2
S8
S9
S10
S11
S12
S13
R4
R2
R3
S3
S4
S5
S6
S7
S1
S2
J11
J10

Figure 5-13.

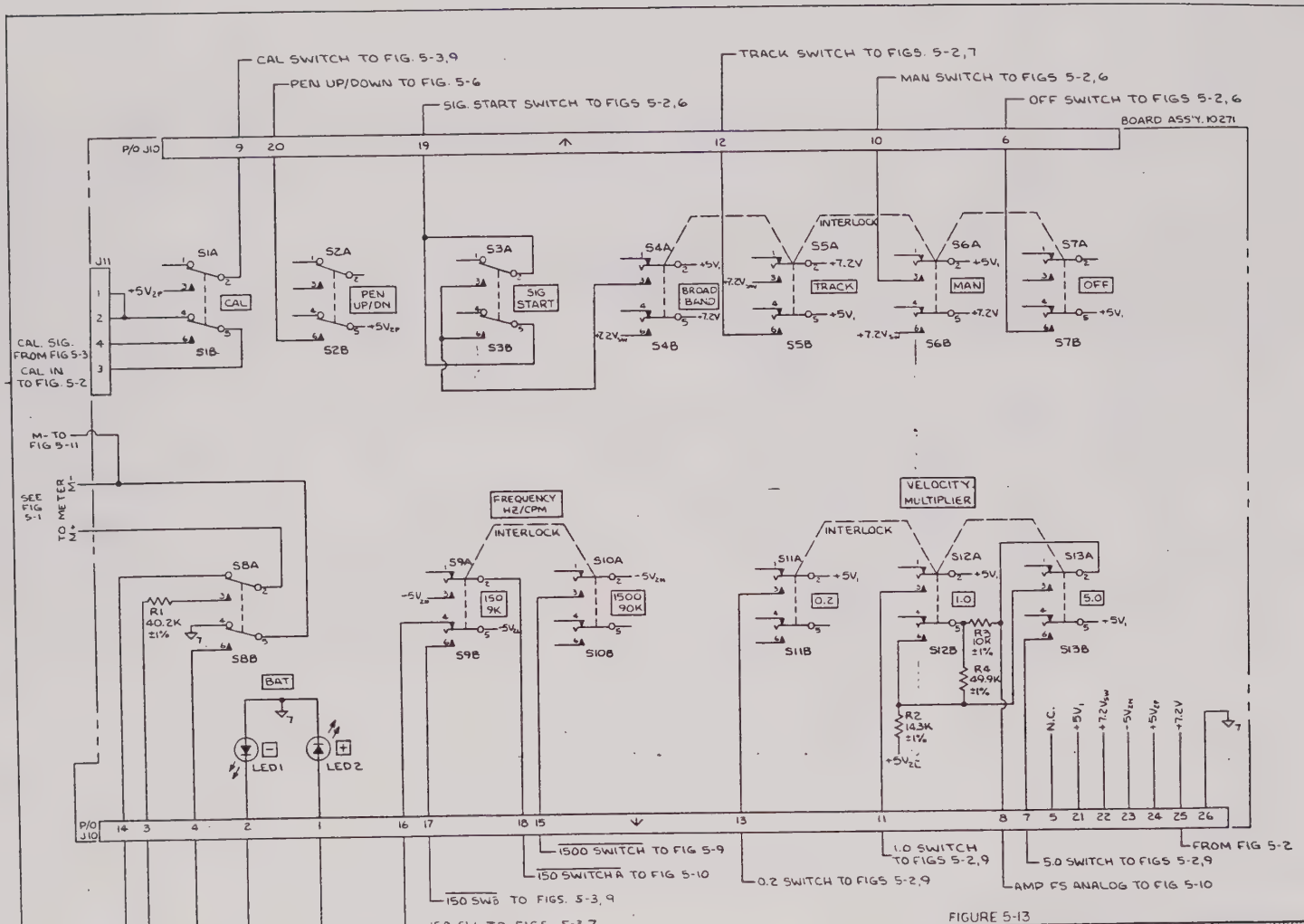


FIGURE 5-13

SCHEMATIC, PANEL

DRAWN VUO	DATE 9-18-81	CODE IDENT NO 13048	Scientific-Atlanta, In
CHK DZZ	APPD BK		New Jersey Division Randolph Park West, Route 10, Randolph, N.J.

TABLE 5-14 REPLACEABLE PARTS LIST

POWER SUPPLY

Power Supply Board Assembly Scientific-Atlanta #10269 consisting of:

Board, Printed Circuit, Scientific-Atlanta #10270

SYMBOL	DESCRIPTION
BT 1	Battery, 6-1.2V Ni-Cad "C" Cells Sanyo #N-1800C
BT 2	Battery, 6-1.2V Ni-Cad "C" Cells Sanyo #N-1800C
C1	Capacitor, 7500 mFD, 15V, Sprague #36DX
C2	Capacitor, 7500 mFD, 15V, Sprague #36DX
CR1	Diode, 1N4001
CR2	Diode, 1N4001
CR3	Diode, 1N4001
CR4	Diode, 1N4001
CR5	Diode, 1N4001
CR6	Diode, 1N4001
F1	Fuse, 1/4A, Buss MDL
F2	Fuse, 2A, Buss AGC
F3	Fuse, 2A, Buss AGC
J15	Header, 3M #3429-2302
K1	Relay, Clare #GP1R11A1000
P16	Cordset, Belden #17237
Q1	Transistor, 2N1305
Q2	Transistor, 2N1304
R1	Resistor, 39Ω, ±10%, 1/2W, AB Type EB
R2	Resistor, 15Ω, ±10%, 2W, AB Type HB
R3	Resistor, 15Ω, ±10%, 2W, AB Type HB
R4	Resistor, 1500Ω, ±10%, 1/4W, AB Type CB
R5	Resistor, 1000Ω, ±10%, 1/4W, AB Type CB
R6	Resistor, 20Ω, 12W, Ohmite #1713
R7	Resistor, 1500Ω, ±10%, 1/4W, AB Type CB
R8	Resistor, 15Ω, ±10%, 2W, AB Type HB
R9	Resistor, 15Ω, ±10%, 2W, AB Type HB
R10	Resistor, 1000Ω, ±10%, 1/4W, AB Type CB
S1	Switch, Slide, DPDT (115/230) UID #SW422-SD-CE-W-BI-HK
T1	Transformer, Scientific-Atlanta B-9875

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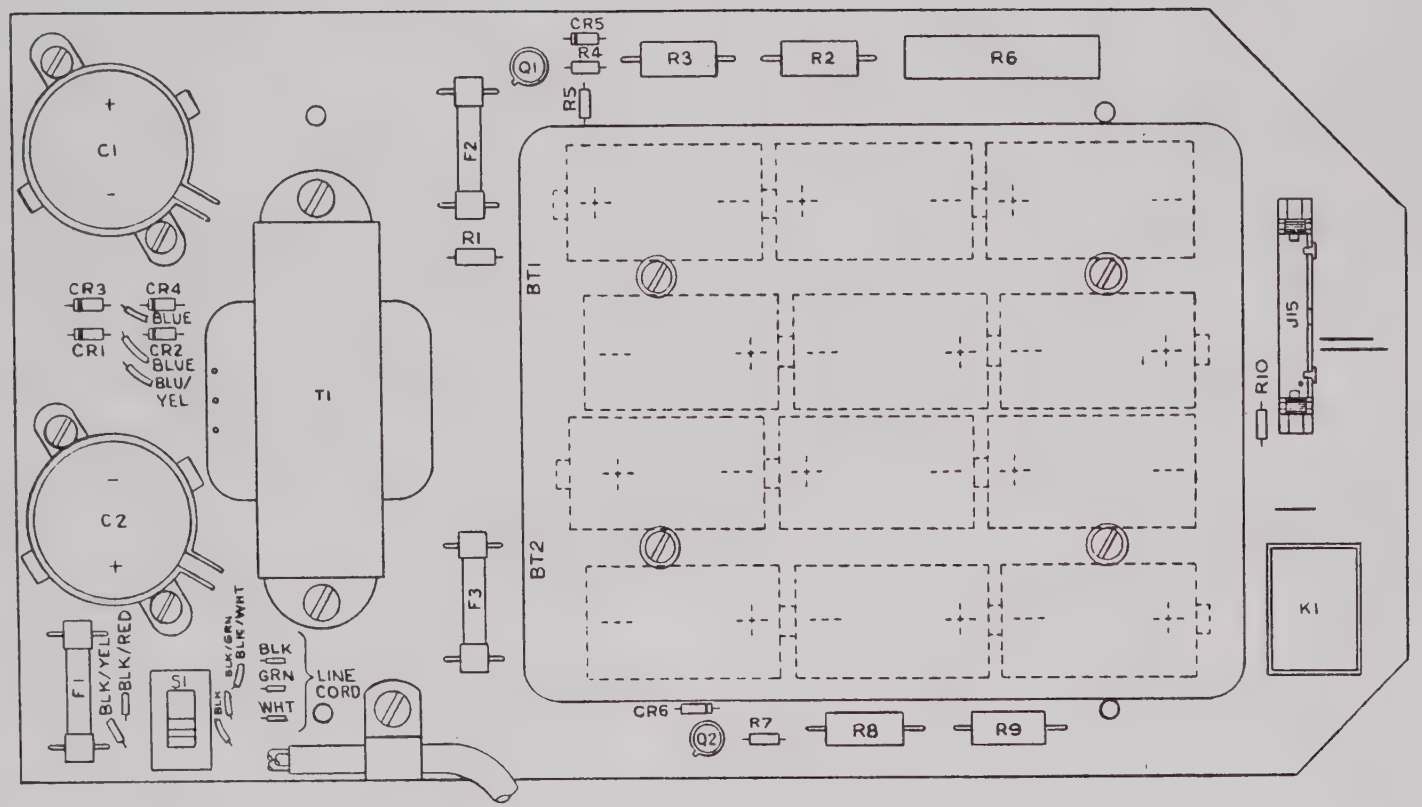

P/O FIGURE 5-14.

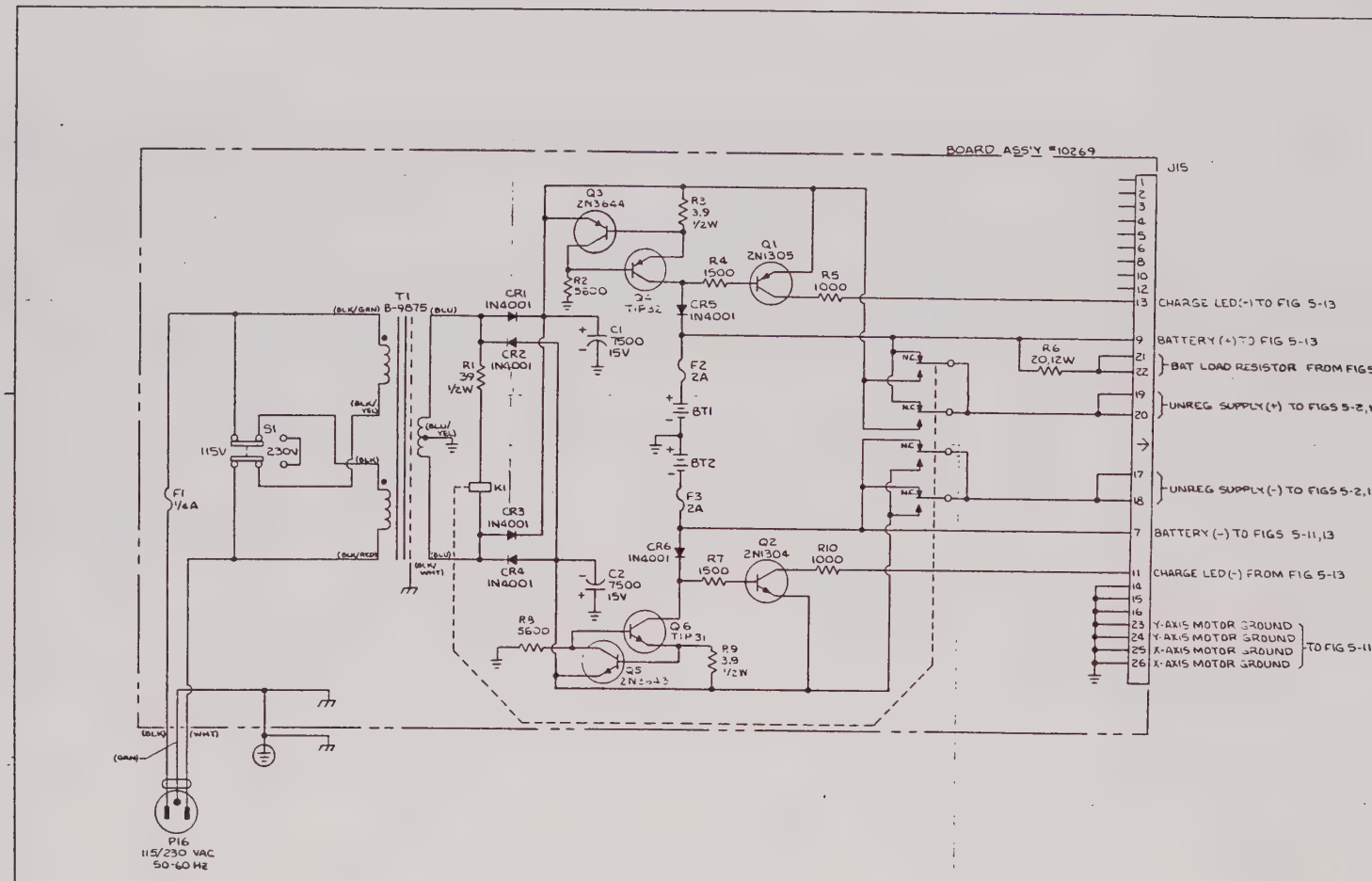

FIGURE 5-14

TITLE: SCHEMATIC POWER SUPPLY			
DRAWN VVO	DATE 9-10-81	CODE IDENT NO 13048	Scientific-Atlanta, Inc.
CHK'D DRZ	APPD [illegible]		
MODEL 2521	SHEET — OF —	DWG NO C-10262	REV G

TABLE 5-15 REPLACEABLE PARTS LIST - MECHANICAL

SYMBOL	DESCRIPTION	QUANTITY
1	Bar, Pen Lift, S-A 10022	1
2	Bracket, Motor/Pot Mtg., S-A 10044	1
3	Bracket, Pen Lift, S-A 10019	1
4	Bracket, X-Y Axis Pulley, S-A 10008-1	1
5	Bracket, X-Y Axis Pulley, S-A 10008-2	1
6	Bracket, X Axis/Y Anchor, S-A 10009-1	1
7	Carriage, X-Y Axis, S-A 10010	2
8	Carriage, Y Axis, S-A 10011	1
9	Cover, S-A 9356-1	2
10	Gear, S-A 9172	2
11	Gear, Ass'y, S-A 9998-1	1
12	Gear, Ass'y, S-A 9998-2	1
13	Guide, S-A 9997-2	2
14	Guide, Card, S-A 9973-1	1
15	Guide, Card, S-A 9973-3	1
16	Guide, Y-Axis, S-A 9346	2
17	Meter, S-A 9167	1
18	Pen Lift, S-A 10023	1
19	Plate, Gear Guard, S-A 10278	1
20	Plate, Y-Axis Carriage, S-A 9995	1
21	Retainer, Card, S-A 9355-2	1
22	Retainer, Pen Lift, Bar, S-A 10092	2
23	Retainer, Spring, S-A 10093	2
24	Rod, Pen Lift, S-A 10021	1
25	Spacer, Card Retainer, S-A 10299	1
26	Spring, Y-Axis Carriage, S-A 9996	1
27	Solenoid, S-A 9863	1
28	Actuator, Microswitch JX-20	1
29	Cable, Sava 2014-SN	A.R.
30	Motor, Barber Coleman FYQM-33200-4-6V	2
31	Pin, Spirol, Cem .052 X 1/8 MCP	1
32	Pin, Spirol, Cem 1/16 X 3/4 MCP	3
33	Pin, Spirol, Cem 3/32 X 3/8 MCP	1
34	Resistor, Var. 10KΩ, Beckman 7486R10K.25	2
35	Ring, Retaining, Truarc 5131-12	4
36	Ring, Retaining, Truarc 5133-12	4
37	Ring, Retaining, Truarc 5555-18	4
38	Screw, Set, 2-56 X 1/8, Allen Hd. Cup Pt.	2
39	Screw, Set, 6-32 X 1/8, Allen Hd. Cup Pt.	4
40	Spring, Assoc. Spring, C0088-008-0620-S	2
41	Switch, Micro Switch, 11SX-21-T	1

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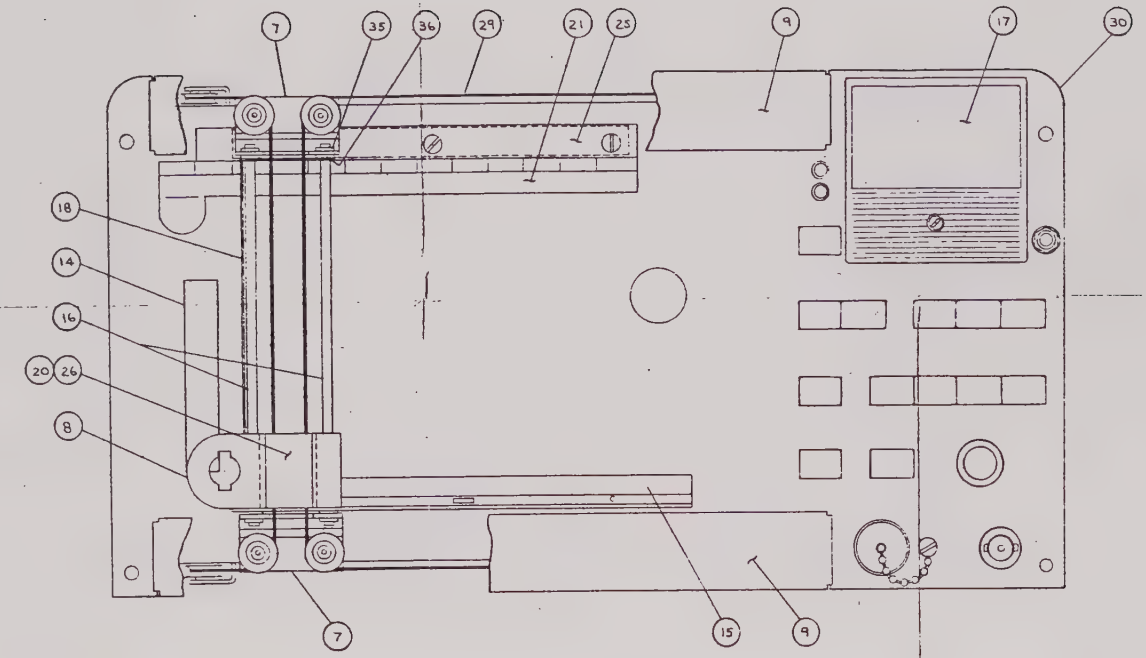
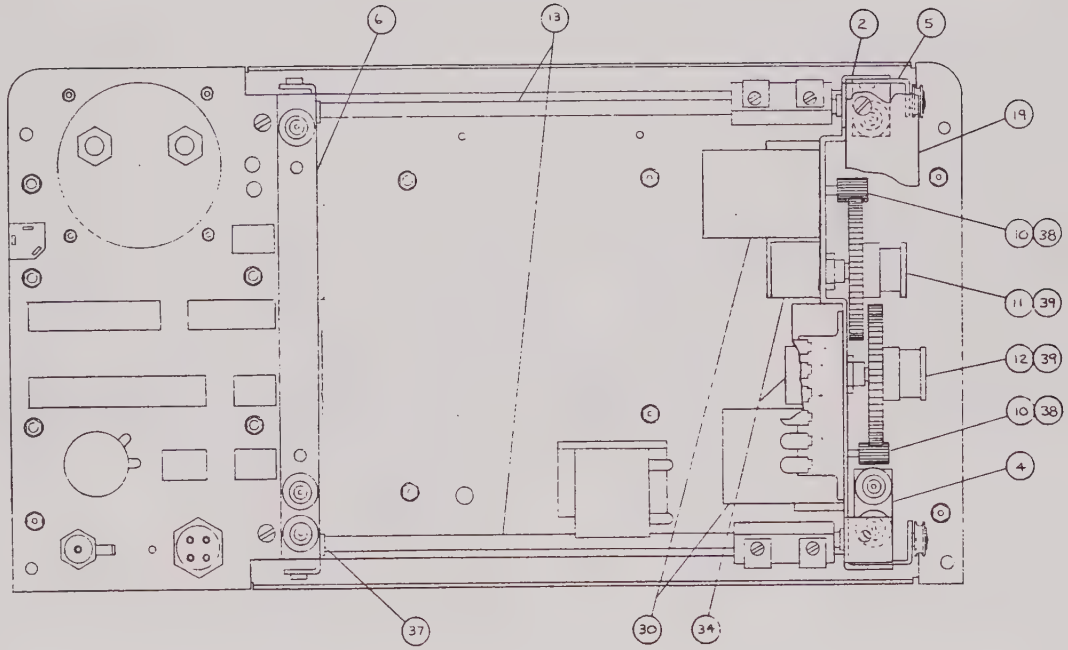


FRONT VIEW

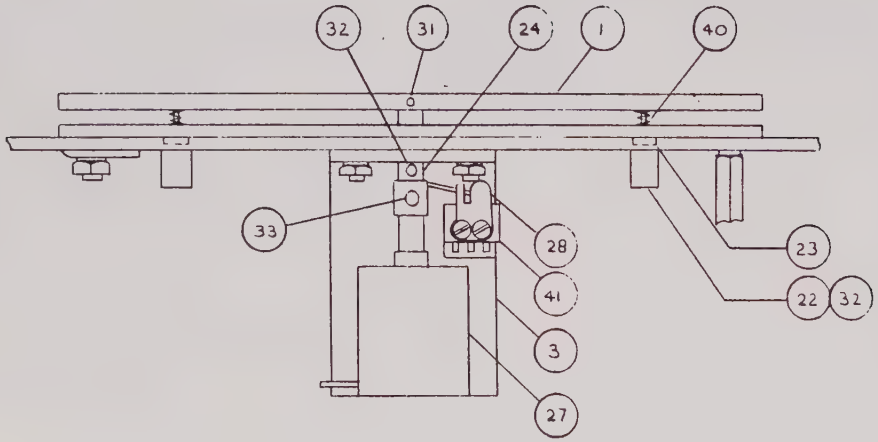
FIGURE 2521 — P/O FIGURE 5-15.



REAR VIEW

P/O FIGURE 5-16.

FIGURE 2021



PEN LIFT

P/O FIGURE 5-15.

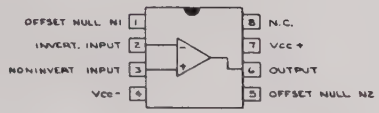
TABLE 5-16 RECOMMENDED SPARE PARTS

Part Number	Description	Recommended Quantity/Unit
Scientific-Atlanta 10263	Signal Assembly Bd.	1
Scientific-Atlanta 10265	Control Bd., Assembly Bd.	1
Scientific-Atlanta 10267	X-Y Recorder, Assembly Bd.	1
Scientific-Atlanta 10269	Power Supply, Assembly Bd.	1
IN276	Diode	1
IN749	Diode	2
IN825	Diode	2
IN914	Diode	7
IN4001	Diode	2
IN4151	Diode	2
B-5638-4-1*	Transistor	1
MPSA18	Transistor	2
2N3644	Transistor	2
2N5953	Transistor	2
2N10304	Transistor	1
2N10305	Transistor	1
TIP31	Transistor	2
TIP32	Transistor	2
A5662-1 (TL084)*	Integrated Circuit	2
A5662-2*	Integrated Circuit	1
A5662-3	Integrated Circuit	1
A5663-2	Integrated Circuit	1
A5663-3	Integrated Circuit	1
A5659-2	Integrated Circuit	1
A5665-2	Integrated Circuit	1
SN72747N	Integrated Circuit	1
AD537JH	Integrated Circuit	1
LM124	Integrated Circuit	1
LM324	Integrated Circuit	1
LM329	Integrated Circuit	1
LM356	Integrated Circuit	1
MC4741CP	Integrated Circuit	1
CD4001AE	Integrated Circuit	1
CD4013	Integrated Circuit	2
CD4015	Integrated Circuit	1
CD4020	Integrated Circuit	1
CD4027	Integrated Circuit	2
CD4030	Integrated Circuit	2
CD4042	Integrated Circuit	1
CD4043	Integrated Circuit	1
CD4047	Integrated Circuit	1
CD4071	Integrated Circuit	1

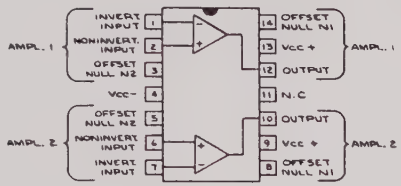
TABLE 5-16 RECOMMENDED SPARE PARTS

Part Number	Description	Recommended Quanity/Unit
TCPR01 Arco	.01 mF, ±20%, 100V Capacitor	2
196D, Sprague	15 mF, 15V, Capacitor	2
PD5B103F, Elpac	.01 mF, ±1%, 50V Capacitor	3
PS11, F-Dyne	.1 mF, ±2%, 75V Capacitor	3
200-050-25V-104	.1 mF, ±20%, 50V Arco Capacitor	3
BH96W, Bliley	180 KHz, Crystal	1
G-B814-2B	Relay	2
GP1RA1000	Relay	1
B-9875*	Transformer	1
CM4-83	Led	1
Scientific-Atlanta A-10333-1*	Switch	2
Scientific-Atlanta A-10333-2*	Switch	1
Scientific-Atlanta A-10333-3*	Switch	1
Scientific-Atlanta A-10333-4*	Switch	1
F4B	Bumper	4
1/4A, MDL, Buss	Fuse	1
2A, AGC, Buss	Fuse	2
N-1800C, Sanyo	Battery	2
A9167*	Meter, Velocity	1
FYQM33200	Variable Resistor	2
Gasket	Gasket	4 ft.
2014-SN	Cable	10 ft.
A9952	Accelerometer	1
A9194	Cable - 10 ft.	1

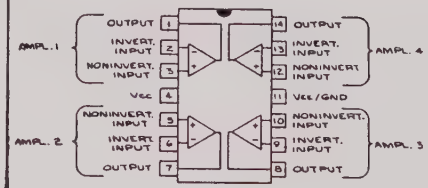
SN72741P
AMPLIFIER



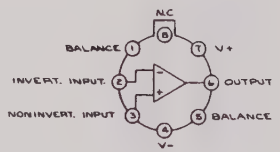
SN72747N
DUAL AMPLIFIER



MA4603-3/LM324/MC4741/TL084CN
QUAD AMPLIFIER

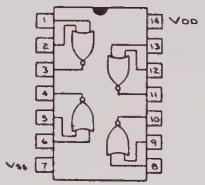


LF356H
AMPLIFIER

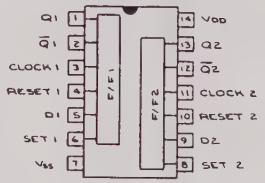


NE555V
TIMER

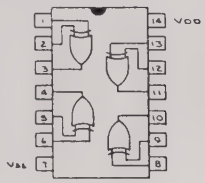
CD4001A
QUAD 2-INPUT NOR GATE



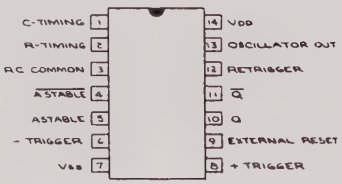
CD4013A
DUAL "D" FLIP-FLOP



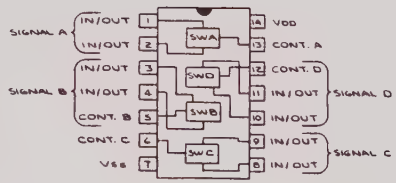
CD4030A
QUAD 2-INPUT EXCLUSIVE-OR GATE



CD4047A
MONOSTABLE/ASTABLE MULTIVIBRATOR



CD4066A
QUAD BILATERIAL SWITCH



CD4518B
DUAL BCD UP COUNTER

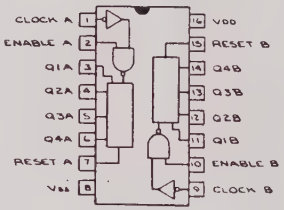


TABLE 5-18.
INTEGRATED CIRCUIT LEGEND

Manual Corrections and Engineering Changes

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2521–9

Tracking Vibration Recorder

The DYMAC Model 2521-9 is a modified 2521. The standard Operator's Manual, together with this appendix, provides the coverage for the Model 2521-9. Only schematics that have been changed are included in this appendix.

Option Description

The –9 modification replaces the 150 Hz analysis range with a 500 Hz range. The effective filter bandwidth is changed from 2.5 Hz to 7.5 Hz. The maximum tracking rate is changed from 1 to 5 Hz per second.

The following list shows what was changed.

Operating frequency of the Voltage Controlled Oscillator

Bandwidth of the I.F. filter

Frequency of the reference clock

Sweep Frequency of the Voltage Controlled Oscillator (from 2000 Hz to 2500 Hz)

The 3 Biquad filters of the second I.F. were widened by changing the RC networks and then re-calibrating each filter.

Frequency of the reference clock was moved by adding a ÷ 3 circuit.

The front panel modified by replacing the "Frequency Hz/CPM" pushbutton 150 Hz/4 kΩ with 500 Hz/30 kΩ. The 30768600 X-Y Plotter Assembly has also been modified.

The following sections of the calibration procedure are changed.

4.4.4 2nd I.F. Filter

4.4.5 Voltage Controlled Oscillator

4.4.6 System Gain

4.4.8 Frequency Calibration

4.4.9 Phase Shifter

These sections of the calibration procedure have the appropriate changes in the frequency and amplitude.

The following replaceable parts list tables are changed.

Table 5-5. Signal – 2nd IF Filter, IF Detector

Table 5-7. Control – VCO, Refresh, Track

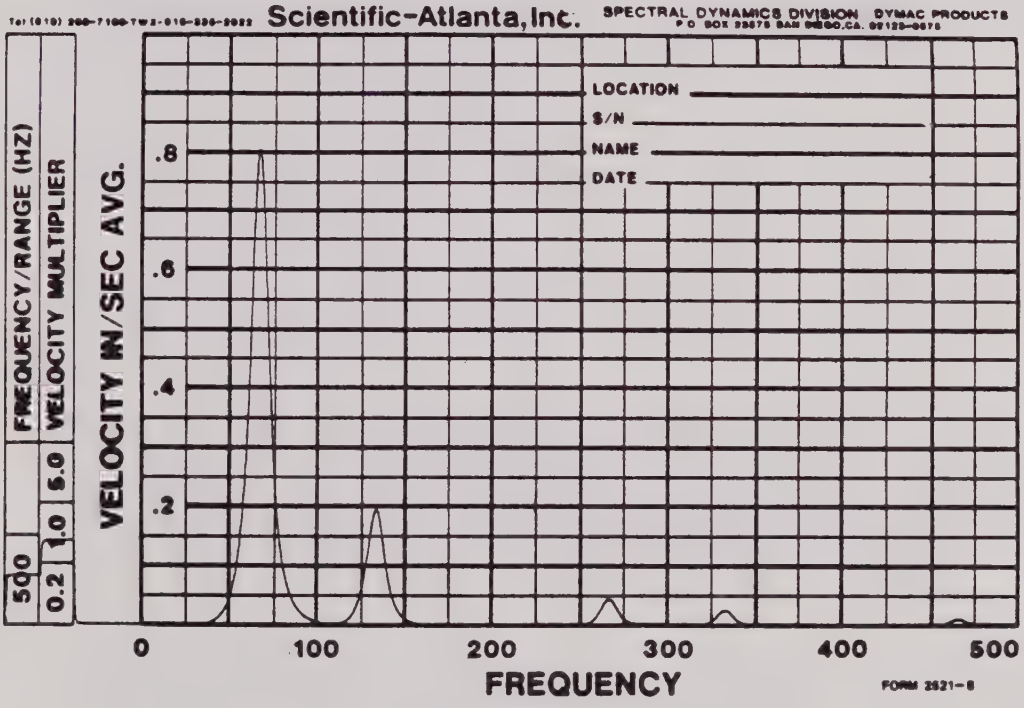
Table 5-8. Control – Strobe Trigger Modulator, LP Filter

Table 5-10. Control – Sweep Sequencer, X-Y Control Logic

There are 2 signature cards for the 2521–9 option.

FORM 2521–8	500 Hz	30386708
FORM 2521–9	1500 Hz	30386709

The signature of the internal cal signal is different for the 500 Hz range only. The following graph shows a typical plot of the cal signal (3rd and 6th harmonics missing).



Maintenance and Calibration

4.1 INTRODUCTION

This section contains information needed to verify specifications, calibrate and maintain the Recorder. Included are procedures for both mechanical and electrical calibration, minor repairs and troubleshooting.

4.2 PERFORMANCE VERIFICATION

4.2.1 Test Equipment Required

- Digital Multimeter - HP3644A or equal
- Signal Generator
- Frequency Counter
- Vibration Calibrator - Gen Rad 1557A or equal
- Recorder cards - 2521-1

4.2.2 Procedure

Each of the following paragraphs describes a test that verifies electrical specification of the recorder. The setting of an electrical specification of the recorder. The setting of input parameters and recorder controls for each test is outlined in the Performance Test Chart, Table 4-1.

4.2.3 Velocity Meter Accuracy

The purpose of this test is to verify the accuracy of the VELOCITY meter. Connect the output of the signal generator to the Recorder INPUT. Set the generator output frequency to 1000 Hz and monitor the amplitude with the multimeter. Press the the Recorder controls as indicated BROADBAND push-button. Set the Recorder controls as indicated on the chart and record the input amplitude required for VELOCITY meter FS indication.

4.2. Spectral Velocity and Frequency Accuracy

The purpose of this test is to verify the accuracy of velocity and frequency measurements recorded on the vibration signature cards. Connect the output of the signal generator to the Recorder INPUT.

Set the input amplitude and frequency and the Recorder controls as indicated on the chart. Insert 2521-1 card and pen. Press the N push-button and manually tune to the input. Press the Track push-button. Press the PEN UP/DN push-button twice making a mark on the card Read the

velocity and frequency at the mark and compare to expected readings. Change pen color whenever the VELOCITY MULTIPLIER is changed.

4.2.5 Internal Calibrator

The purpose of this test is to verify the internal calibrator is functioning properly. Install a 2521-1 card and pen. Set recorder controls as indicated in table. Press the BROADBAND push-button. Press the CA pushbutton and hold pressed. Press the SIG START pushbutton and observe recording being made. Read the amplitude and frequency of the first peak and compare to expected readings.

4.2.6 Accelerometer

The purpose of this test is to verify the accelerometer is functioning properly. Install a 2521-1 card and pen. Set Recorder controls as indicated in table. Mount the 9952 accelerometer supplied with the Recorder to the vibration calibration. Connect the accelerometer to the Recorder using the 9194 cable supplied. Press BROADBAND pushbutton. Press SIG START push-button. Read the peak velocity and frequency and compare to expected readings.

4.3 PREPARATION FOR CALIBRATION

4.3.1 Test Equipment Required

- Digital Multimeters - H3466A or equal
- Signal Generator - HP3325A or equal
- Frequency Counter - Data Precision 5740 or equal
- Recorder Cards - 2521-1
- BNC Terminations - 50, 75 or 1500 ohm
- Oscilloscope - Tektronix 465 or equal
- Resistors 194 ±1 ohm and 1746 ±1 ohm

4.3.2 Removal from Case

Before removing the Recorder from the case, press the OFF pushbutton and disconnect the line cord from ac power. Remove the four screws holding the Recorder Located at the corners of the front panel. They are the largest of the front panel screw heads. carefully lift the Recorder vertically out of the case until the ribbon cable is all that connects the panel to the case. Place the Recorder panel face down on a soft surface to avoid scratches. In the event that cabling procedures are necessary, disconnect the ribbon cable from the power supply board. The retaining clips must be split apart to extract the ribbon cable connectors.

Table 4-1. Troubleshooting Chart

SYMPTON	PROBABLE CAUSE	REMEDY
1. Unit fails to operate in any mode, AC or DC	a) Power supply cable loose	a) Check power supply cable
	b) Line fuse bad	b) Check line fuse and replace if necessary
	c) Power-up circuit malfunction	c) Check power-up circuit (Refer to section 3.5.1)
2. Unit operates on AC power only	a) Battery condition very low	a) Check battery condition and charge for 14-16 hours
	b) Battery fuses bad	b) Check battery fuses and replace
	c) Defective power supply relay	c) Check power supply circuit (Refer to section 3.9)
3. Broadband meter does not indicate	a) Defective accelerometer or cable	a) Check and replace if necessary
	b) Input signal conditioning malfunction	b) Conditioning circuits and broadband detector (Refer to sections 3.5.1 and 3.5.2)
4. Pen does not move in X direction	a) X-axis cable broken	a) Inspect and replace cable (Refer to section 4.5)
	b) X-axis drive circuit defective	b) Check X-axis drive circuit (Refer to section 3.7)
	c) Malfunction in X-Y control logic	c) Check X-Y control logic (Refer to section 3.6)
5. Pen does not move in Y direction at any time	Same as above for Y-axis	Same as above for Y-axis
6. Pen does not move in Y direction during frequency sweep or in manual mode	a) VCO malfunction	a) Check VCO circuit (Refer to section 3.6.2)
	b) Input signal conditioning malfunction	b) Check input signal conditioning circuits (Refer to section 3.5.1)
	c) First modulator malfunction	c) Check first modulator circuit (Refer to section 3.5.2)
	d) First IF filter/second modulator malfunction	d) Check first IF/second modulator circuits (Refer to figure 3.5.3)
	e) Second IF filter/IF detector malfunction	e) Check second IF/IF detector circuits (Refer to section 3.5.4)
7. Unit will not plot internal calibrator signal	a) Calibrator circuit malfunction	a) Check calibrate circuit (Refer to section 3.5.2)
8. Erratic X or Y-axis movement	a) Low battery condition	a) Check battery condition and charge 14-16 hours if necessary
	b) Defective servo pot	b) Inspect appropriate pot - replace if necessary
9. Unit will not track a signal	a) Insufficient signal level	a) Use more sensitive amplitude range
	b) Input signal exceeds maximum tracking rate	b) Use high frequency range for faster tracking rate (Refer to section 2.3.4)
	c) Tracking circuitry malfunction	c) Check tracking circuitry (Refer to section 3.6.2)
10. Batteries will not charge	a) Line fuse bad	a) Check line fuse and replace if necessary
	b) Battery fuses bad	b) Check battery fuses and replace if necessary
	c) Charging circuit malfunction	c) Check charging circuit (Refer to section 3.9)
11. Batteries will not hold a charge	a) One or more defective cells	a) Check cells and replace as necessary
12. Unit will not turn off when "OFF" button is pressed	a) Malfunction in power-up circuit	a) Check power-up circuit (Refer to section 3.5.1.)

4.3.3 Identification

Each PW board has a descriptive name and assembly number that can be found on the schematic diagram in section 5. The assembly number is also stamped on the component side of the PW board. Test points and adjustment are called out by a descriptive name in the calibration procedure.

4.4 CALIBRATION PROCEDURE (Refer to Figure 4-1.)

Perform each step of the procedure in the order presented. All signals are measured with respect to GROUND (TP3, 10263).

4.4.1 Set Up Inhibits

1. Short the input connector with a short clip lead or a standard 50 or 75 ohm BNC termination.
2. Connect a jumper from MOTOR DRIVE INHIBIT (TP3, 10267) to +5V2 (TP1, 10263).

4.4.2 Power Supplies

1. Press the MAN pushbutton.
2. Adjust -5V (R33, 10263) for -5V ±4 mV at -5V2 (TP2, 10263).
3. Adjust +5V (R36, 10263) for +5V ±4 mV at +5V2, (TP1 10263).

4.4.3 1st IF Filter

1. Connect a jumper from 2 kHz REF (TP1, 10265) to 1st IF input (TP4, 10263). Rotate the manual tune control fully clockwise.
2. Monitor the 2 kHz signal at 1st IF OUT (TP7, 10263) with the oscilloscope.
3. Adjust alternately FREQ (R67, R74 and R81, 10263) for maximum amplitude, approximately 170 mV p-p.
4. Remove the connection made in step 1.

4.4.4 2nd IF Filter

1. Connect a jumper from 200 Hz REF (TP6, 10263) to 2nd IF INPUT (TP9, 10263).
2. Press the 500 Hz frequency pushbutton.
3. Monitor the 200 Hz signal at 2nd IF OUT (TP10, 10263) with the oscilloscope.
4. Adjust alternately FREQ (R95, 104, 133, 10263) for a maximum amplitude, approximately 1.25 V p-p.
5. Remove the connector made in Step 1.

4.4.5 Voltage Controlled Oscillator (Refer to Figure 5-7.)

1. Connect a 1000 ohm resistor across capacitor C24. Rotate the manual tune control fully counter clockwise. Verify that the voltage at IC14 pin 6 is less than 0.1 V.
2. Monitor VCO phase 1 (TP5, 10263) with the frequency counter.
3. Adjust 2000 Hz (R53, 10265) for 2000 ±1 Hz.
4. Rotate the manual tune control fully clockwise. Adjust 2500 Hz (R43, 10265) for 2500 ± 10 Hz.
5. Press the 1500 Hz frequency pushbutton.
6. Adjust 300 Hz (R46, 10265) for 3500 ±20 Hz.
7. Remove the 1000 ohm resistor added in Step 1.

4.4.6 System Gain

1. Press the 0.2 VELOCITY MULTIPLIER pushbutton.
2. Monitor IF DET OUT (TP11, 10263) with a digital voltmeter. Adjust 500 and 1500 Hz GAIN (R130 and R131, 10263) fully clockwise. Adjust DET ZERO (R122, 10263) for 0 ±2 mVdc.
3. Adjust METER ZERO (R38, 10263) for a VELOCITY meter indication of zero.
4. Press the OFF pushbutton and wait for the off sequence to finish. Remove the jumper from MOTOR DRIVE INHIBIT (TP3, 10267).
5. Remove the short from the INPUT connector and connect the signal generator to the INPUT. Set the generator output to 115.0 ±1 mV rms at 1000 ±1 Hz.

e. Press the MAN and 1.0 VELOCITY MULTIPLIER pushbuttons.

7. Adjust the manual tune control until the recorder Y-axis is peaked and press the TRACK pushbutton.
8. Monitor IF DET OUT (TP11, 10263) with a digital voltmeter and adjust 1500 Hz GAIN (R130, 10263) for 1.00 ±0.02V dc.
9. Press the 500 Hz FREQUENCY pushbutton.
10. Set the generator output to 38.3 ±0.1 mV rms at 333 ±1 Hz.
11. Press the MAN pushbutton and tune the recorder until the Y-axis peaks.
12. Press the TRACK pushbutton.
13. Adjust 500 Hz GAIN (R131, 10263) for 1.00 V ±0.01 Vdc.
14. Adjust METER FS (R48, 10263) until the VELOCITY meter reads full scale.

15. Disconnect the signal generator and replace with short or BNC termination.

4.4.7 X-Y Recorder

1. Insert s 2521-1 recorder cad and pen. Turn Y LIMIT and X LIMIT (R4 and R35, 10267) full clockwise.
2. Press the MAN pushbutton.
3. Rotate the MAN tune control fully clockwise.
4. Adjust X GAIN (R38, 10267) until the pen sits on the full scale frequency grid line.
5. Rotate the MAN tune control fully counter-clockwise.
6. Adjust X ZERO (R44, 10267) until the pen sits on the zero frequency grid line.
5. Repeat step 4, 5, 6 and 7 until the pen sits on the full scale or zero grid lines then the MAN tune control is rotated fully CW or CCW, respectively.
8. Rotate the MAN tune control fully clockwise.
9. Adjust X GAIN (R38, 10267) until the pen moves 1/16 inch to the right of the grid area.
10. Rotate X LIMIT (R35, 10267) counterclockwise until the pen begins to move.
11. Adjust X GAIN (R38 , 10267) until the pen sits on the full scale frequency grid line.
12. Press the 1.0 VELOCITY MULTIPLIER and 1500 Hz FREQUENCY pushbuttons.
13. Adjust Y ZERO (R13, 10267) until the pen sits on the zero velocity grid line.
14. Remove the termination from the INPUT connector and connect the signal generator to the INPUT.Set the generator output to 115 ±1 mV rms, 1 kHz sine wave.
15. Adjust the MAN tune control and tune to the input. Press TRACK pushbutton.
16. Adjust Y GAIN (R7, 10267) until the pen sits on the full scale velocity grid line.
17. Replace INPUT short and repeat step 13, 14, 15 and 16 until the pen sits on the zero or full scale velocity grid lines with a short or a 115 ±1 mV rms, 1000 ±1 Hz at the input.
18. Connect the generator to the INPUT connector. Tune to and track a 1000 Hz signal. Adjust the amplitude to approximately 125 mV rms.
19. Rotate Y LIMIT (R4, 10267) counterclockwise until the pen sits 1/16 inch above the full scale velocity grid line.

4.4.8 Frequency Calibration

1. Insert a 2521-9 signature card and pen, Press the MAN pushbutton.
2. Press the 500 Hz FREQUENCY pushbutton and tune to 466 Hz.
3. Press the 1.0 VELOCITY MULTIPLIER pushbutton.
4. Connect the signal generator to the INPUT connector. Set the generator output to 33 ±1 mV rms at 466 ±1 Hz.
5. Press the TRACK pushbutton.
6. Press the PEN UP/DN pushbutton.
7. Adjust 2500 Hz (R43, 10265) until the pen sits on the 140 Hz card line.
8. Press the PEN UP/DN and MAN pushbuttons.
9. Press the 1500 Hz FREQUENCY pushbutton and tune to 1400 Hz.
10. Set the generator output to 100 ±10 mV rms at 1400 ±1 Hz.
11. Press the TRACK and PEN UP/DN pushbutton.
12. Adjust 3500 Hz (R46, 10265) until the pen sits on the 1400 Hz card line.
13. Press the MAN pushbutton.

4.4.9 Phase Shifter

1. Press the 500 Hz FREQUENCY and the 5.0 VELOCITY MULTIPLIER pushbuttons.
2. Set the generator output to 64 ±5 mV peak to peak square wave at 50 ±2 Hz.
3. Monitor the generator output and the STR TRIGGER (BLACK, J5) on a dual trace scope. Sync the scope with the generator output positive edge. Adjust the scope sweep for 1 ms/cm.
4. Press the MAN pushbutton and tune to 50 Hz.
5. Press the TRACK pushbutton.
6. Connect a 1746 ohm resistor from STR ADJUST (RED, J5) to ground at 15.
7. Note the position of the STR TRIGGER falling edge. Replace the 1746 ohm with 194 ohm ±1 ohm. Again note the position of the falling edge.
8. Adjust PHASE FS (R64, 10267) until the time between the rising edges noted is 4.0 ±0.3 ms. Turning R64 CW will increase the time while turning ccw will decrease the time.

4.5 RECORDER CABLING PROCEDURES

4.5.1 Test Equipment Required

Digital Multimeter - HP3466A or equal.

Spring Scale, 36 oz. range in 1.2 oz. increments - Chatillon or equal.

4.5.2 Y-Axis Cabling (Refer to Figures 4-2 and 5-1.)

1. Remove the Recorder from the case as per paragraph 4.3.2 and disconnect P15 from assembly 10269.
2. Refer to figure 5-15 and remove the two cable covers symbol. There's one #4 screw at each end of a cover.
3. Remove the four screws and two nuts securing the Analyzer Board and carefully fold the board out of the way.
4. Rotate the Y-Axis variable resistor shaft slowly in a clockwise direction until its end stops prevent further rotation. The variable resistor shaft can be easily turned by rotating its attached gear assembly, symbol 12 in Figure 5-15. The retaining holes in the groove of the pulley should be directed toward the panel. Refer to Figure 4-2b.
5. Check to be certain that the body of variable resistor, symbol 14 of Figure 5-15 cannot rotate. If it is loose, anchor it by tightening its retaining nut located between the gear and the bracket. Once this is secure, loosen the two set-screws, symbol 39, holding the gear assembly to the variable resistor holding the gear assembly to the variable resistor shaft. Rotate the gear assembly in a clockwise direction until the cable retaining holes in the groove of the pulley are directed toward the panel. Tighten the two set-screws in the pulley hub.
6. Draw a pencil mark on the large gear at a point opposite the panel and the cable retaining holes as indicated in Figure 4-2b. Carefully rotate the large gear 24 turns counterclockwise. The pencil mark should now be adjacent to the panel and the midpoint between the cable retaining holes should fade away from the panel as indicated in Figure 4-2f. Install the temporary Locking Clip as indicated in Figure 4-2f. The outer wire loop of a 1 3/4" long paper clip will do nicely. CAUTION should be exercised when using this clip as any excessive tension in the cable or trying to force the gears against the clip may damage the gear teeth.
7. Measure 70 inches of cable and thread it through the retaining holes (Figure 4-2c). Adjust the cable lengths so that end N is 10 inches longer than end M. Tie a small loop at the end of N.

8. Use a rubber band to retain the pen holder against a 1 7/8" spacer (see Figure 4-2E). A length of pencil with electrical tape on the end will do for the spacer.

9. Wind cable end M, 3 turns counterclockwise to the gear side of the retaining holes, keeping the turns nested tightly together. Refer to Figure 4-2d. Route this end of the cable around the Y-axis pulleys (see Figure 4-2f). String the cable between the anchor clip and the Y-Axis anchor bracket, symbol 6, of Figure 5-15. Take the slack out of the cable and clamp the cable end in place by tightening the screw.

10. Returning to the bottom at the panel, wind 3 closely nested turns clockwise around the pulley with the remaining length of cable as shown in Figure 4-2e. Route this end of the cable around the remaining Y-Axis pulleys in accordance with Figure 4- 2f. Anchor the cable with the remaining anchor clip by tightening the screw.

11. Remove the rubber band, spacer and the temporary locking clip from the gears.

12. Refer to Figure 4-2f, to adjust the cable tension. Position the spring scale as indicated in line with the cable. While maintaining tension on the cable, loop with the spring scale, loosen the clamping screw on the anchor clip until the cable slides freely. Increase the tension of the spring scale until a reading of 21 ft. oz. is obtained. Retighten the clamping screw. Trim off the excess cable leaving a 3/8 inch length at each end.

13. Reposition the Analyzer Board and secure it with the hardware removed in paragraph 4.5.2.3.

14. Replace the two cable covers with the hardware removed in paragraph 4.5.2.2.

4.5.3 X-Axis Cabling (Refer to Figures 4-3 and 5-15)

1. Remove the Recorder from the case as per paragraph 4.3.2 and disconnect P15 from assembly 10269.

2. Refer to Figure 5-15 and remove the two sable covers, symbol 9. There's one #4 screw at each end of a cover.

3. Remove the four screws and two nuts securing the Analyzer Board and carefully fold the board out of the way.

4. Rotate the X-axis variable resistor shaft slowly in a clock-wise direction until its end stops prevent further rotation. The variable resistor shaft can be easily turned by rotating its attached gear assembly, symbol 11 in Figure 5-15. The cable retaining holes in the groove of the pulley should be directed away from the panel. Refer to Figure 4-3b.

5. Check to be certain that the body of variable resistor, symbol 34 of Figure 5-15 cannot rotate. If it is loose, anchor it by tightening its retaining nut located between the gear and the bracket. Once this is ensured, loosen the two set-screws holding the gear assembly, symbol 39, to the variable resistor shaft. Rotate the gear assembly in a clockwise direction until the cable retaining holes in the groove of the pulley are directed away from the panel. Tighten the two set-screws in the pulley hub.

6. Draw a pencil mark on the large tear at a point opposite the panel as indicated in Figure 4-3b. Carefully rotate the large gear 2 1/2 turns counterclockwise. The pencil mark should now be adjacent to the panel as should the midpoint between the cable retaining holes as indicated in Figure 4-3f. Install the temporary Locking Clip as indicated in Figure 4-3f. The outer wire loop of a 1 3/4" long paper clip will do nicely. CAUTION should be exercised when using this clip as any excessive tension in the cable or trying to force the gears against the clip may damage the gear teeth.

7. Referring to Figure 4-3c, thread a 70 inch length of cable through the retaining holes. Adjust cable end M to a length of 25 inches and tie a small loop at its end.

8. Use a rubber band to retain the X-Axis Bracket against a 2 7/8" spacer in accordance with Figure 4-3f. A length of pencil with electrical tape on the ends will do for the spacer.

9. Referring to Figure 4-3d, wind length N, 3 turns clockwise to the side away from the gear keeping the turns nested tightly together. Route this end of the cable around the X-Axis pulleys (see figure 4-3f). Note cross-over caution in Figure 4-3f. String the cable through the anchor clip at "B". Take the slack out of the cable and clamp the cable end in place by tightening the screw.

10. Wind 3 turns counterclockwise to the gear side of the retaining holes keeping the turns nested tightly together. Route this end of the cable, end M, Figure 4-3F around the remaining X-Axis pulley (Figure 4-3f) through the remaining clip at "A". Take the slack out of the cable and clamp it in place by tightening the anchor screw.

11. Remove the rubber band, spacers and the temporary locking clip from the gears.

12. Refer to Figure 4-3f to adjust the cable tension. Position the spring scale as indicated, in line with the cable. While maintaining tension on the cable loop with the spring scale, loosen the clamping screw on the anchor clip at "A" until the cable slides freely.

Increase the tension on the spring scale until a reading of 31 ft. oz. is obtained. Retighten the clamping screw. Trim off the excess cable leaving a 3/8" length at each end.

13. Slide the carriage slowly to the Motor/Pot Mounting Bracket, Figure 5-15 symbol 2. The X-axis brackets at each end of the Y- axis rods should be positioned as closely as possible to the Motor/Pot Mounting Bracket. Tighten the anchor clips at "e" to clamp the cable.
14. Reposition the Analyzer Board and secure it with the hardware removed in paragraph 4.5.3.3.
15. Replace the two cable covers with the hardware removed in paragraph 4.5.3.2.

4.5.4 Recorder Cabling Checks (Refer to Figures 4-1, 4-2, 4-3 and 4-4.)

After the cabling procedure in paragraphs 4.5.2 and 4.5.3 are completed, the following checks must be made to determine if the servo positioning variable resistors, R1 (X-axis) and R2 (X-axis) are positioned correctly and that the cable has been wound correctly on the gear pulleys.

1. To check tension in the Y-axis cable, turn the panel face up and slide the pen holder to the position shown in Figure 4-4a. Use a spring scale to pull at a right angle to the cable at the location indicated in Figure 4-4a. Pull on the cable until it just touches the Y-Axis Guide. The scale should indicate 4 ft. oz. If the reading is beyond this range, loosen one of the clamping screws on a Y-axis Anchor Clip, Figure 4-2f, and adjust the cable tension to the proper value. Tighten the clamping screw.
2. To check the tension in the X-Axis cable, refer to Figure 4-4b. Place the panel face on cushioning material and slide the X-axis bracket to the stop indicated in Figure 4-4b. Using a spacing scale, pull at a right angle to the cable at the location indicated in Figure 4-4b. The displacement should be 1/4" when the reading is taken. The scale should indicate 6 ±oz. If the reading is beyond this range, loosen one of the clamping screws at "A" or "B", Figure 4-3f, and adjust the cable tension to the proper value. Tighten the clamping screw.
3. Reconnect P15 to assembly 10269.
4. Connect a jumper from MOTOR DRIVE INHIBIT (TP3, 10267) to +5V2 (TP1, 10263).
5. Insert a blank card and a pen.
6. Press the MAN pushbutton and carefully move the pen carriage so that the pen tip rests at the lower left printed corner of the card.

7. Measure the voltage at Y-POSITION (TP2, 10267) and X-POSITION 10267) and X-POSITION (TP5, 10267) with a DVM. If the recorder was properly cabled these test points should read 1 V ±150 mV dc.
8. Press the OFF pushbutton.
9. Remove the connection from MOTOR DRIVE INHIBIT (TP3, 10263) to +5V2 (TP1 , 10263) and refer to Section 4.4.5 for calibration of the recorder circuit board.

4.6 MINOR REPAIR PROCEDURES

4.6.1 Battery Replacement (Refer to Figure 5-14.)

1. Disconnect line cord from ac power.
2. Remove the recorder from the case. Refer to Section 4.3.2.
3. Disconnect P15 from assembly 10269.
4. The plastic container on assembly 10269 contains the batteries (BT1 and BT2).
5. Remove the four screws visible on the top of the battery pack and carefully remove the hardware from the case.

CAUTION

Keep conductive material away from the fuse clips and the batteries. A short circuit in this area can discharge the battery pack energy. There is sufficient energy in the battery pack to generate sparks, cause burns and fuse tools.

6. There are 12 separate cells inside the battery pack. Replace the cells making certain that the cells are in series in accordance with the indicators on the bottom of the battery pack and Figure 5-14.
7. Make certain that all of the spring contacts are making proper connections.
8. Inspect for and remove any debris that may have fallen into the battery pack.
9. Reposition the battery pack cover and secure it with the hardware removed in step 5. Note that the lock washer must be sandwiched between the head of the screw and the flat washer.
10. Carefully tilt the case to its rear after securing the accessory compartment door and removing the loose cards and pens. Remove any debris that can be seen.
11. Connect P15 to assembly 10269.
12. Carefully replace the panel assembly in the case and secure it with the hardware removed in Section 4.3.2.

4.6.2 Discrete component Replacement on PC Board

1. Disconnect all power to the equipment.
2. Remove the panel assembly from the case. Refer to Section 4.3.2.
3. Locate the defective component.

4.6.3 COS/MOS IC Replacement and Handling

1. When removing COS/MOS IC's, remove the solder around each lead and gently nudge each lead until it is free from any foil contact.
2. Remove the IC from the board and replace ONLY with the same type. The following information is presented to acquaint those unfamiliar with the handling of COS/MOS IC's.
3. The input protection networks incorporated in most COS/MOS devices are effective in a wide variety of device handling situations. To be totally safe, however, it is desireable to restate the general conditions for eliminating all possibilities of device damage. Since COS/MOS devices have extremely high input resistance, they are susceptible to damage when exposed to extremely high static electrical charges. To avoid possible damage to the devices during handling, testing, or actual operation the following procedures should be followed.

    a. The leads of devices should be in contact with a conductive material, except when being tested or in actual operation, to avoid build-up of static charge

    b. Soldering iron tips, metal parts of fixtures and tools, and handling facilities should be grounded.

    c. Devices should not be inserted into or removed from circuits with the power on because transient voltages may cause permanent damage.

    d. Signals should not be applied to the inputs while the device power supply is off.

    e. All unused input leads must be connected to either Vss (ground) or Vdd (supply voltage), VSS, whichever is appropriate or the logic circuit involved.

4.6.4 Handling of Subassembly Boards

After COS/MOS IC's have been mounted on circuit boards, proper handling precautions should still be observed. Until these subassemblies are inserted into a complete system in which the proper voltages are applied, the board is no more than an extension of the leads of the device mounted on the board.

It is good practice during processing operations to put conductive clips or conductive tape on the circuit board terminals. The precaution prevents static charges from being transmitted through the board wiring to the devices mounted on the board.

All normal flux removing and degreasing solvents can be used. Without adversely affecting the reliability of COS/MOS plastic devices.

4.6.5 Soldering Time and Temperature

All device leads can withstand exposure to temperature as high as 265°C for 10 sec, MAX. and as close as 1/16 ±1/32 inch from the body of the device.

4.6.6 Storing of Printed Circuit Boards

Excessive humidity (greater than 60%) should be avoided during circuit board check-out to prevent the false impression of excessive device internal leakage. High relative humidity may cause leakage paths between closely spaced elements of the circuit boards, such as the terminals and insulated metallized connection strips. Normally this added leakage is not significant in non-COS/MOS devices, however, when the nanoampere-leakage advantages of COS/MOS devices are desired, leakage currents on circuit boards or non-hermetic modules which are affected by high humidity become a major concern and must be controlled by coating, cleaning or better environmental controls.

4.7 TROUBLESHOOTING

4.7.1 Logical Troubleshooting

1. Symptom Recognition: This is the first step in the troubleshooting procedures and is based on a complete knowledge and understanding of the equipment operating characteristics. Because visual indicators are an integral part of the circuitry, the trouble is frequently apparent from the presentation. All equipment troubles are not the direst result of a component failure and are not always easy to recognize, since all conditions of less than peak performance are not always apparent. Degradation in equipment performance is usually detected during preventive maintenance procedures. It is important that the "not so apparent" trouble as well as the apparent troubles be recognized.
2. Symptom Elaboration: After an equipment trouble has been "recognized" all available built-in trouble-shooting aids should be used to elaborate on the original trouble symptom. Use of front panel controls and built-in data indicator presentations may provide better identification of the original trouble

symptom. For example, a faulty plotting symptom may be elaborated upon by changing the FREQUENCY to see if it is dependent upon switch settings. Frequently narrowing down the probable trouble area results with this technique. Also, checking or otherwise exercising the front panel controls may reveal that incorrect settings exist which have been overlooked.

3. Listing Probable Faulty Function: The next step in logical troubleshooting is to formulate a number of "logical choices" as to the cause and likely location (functional section) of the trouble. The "logical choices" are mental questions which are based on a knowledge of the equipment operation, full identification of the trouble symptom, and information contained in this manual. The overall functional description and its associated block diagram should be referred to when selecting possible faulty functional sections.

4. Localizing the Faulty Function: For the greatest efficiency in localizing trouble, the functional sections which have been selected by he logical choice method should be tested in an order that will require the least time. This requires a mental selection to determine which section to test first. The selection should be based on the validity of the logical choice and the difficulties in making the necessary tests. If the tests do not prove that functional section to be at fault, the next selection should be tested, and so on until the faulty functional section is located.

5. Localizing trouble to the circuit once the faulty functional section has been isolated, the task of localizing trouble to a circuit level becomes a matter of signal tracing the suspected functional section. Toward this end, standard signal tracing methods should be employed, e.g., voltages and/or waveforms could be traced throughout the functional section, starting at the input and working towards the output of that section. Once the defective circuit is localized, the next step is replacement of a circuit board or component on a board. A normally functioning circuit is proof of proper fault isolation. The block diagrams, schematic diagram, and their associated discussions are provided for troubleshooting at the circuit level.

6. Failure Analysis: Before performing the actual repair or corrective action, review the process which led to the faulty component to determine why the fault caused the symptoms it did. In some cases a review of the process may prove that the faulty component is a result of a failure instead of the failure itself. In this

instance, further troubleshooting is required. The review and proper failure records will also prove a valuable case history for future equipment failures.

4.7.2 Recommended Test Equipment

Refer to Section 4.3.1.

4.7.3 Troubleshooting Chart

Table 4-2 Troubleshooting Chart gives some idea of the symptoms that occur should the instrument malfunction. Probable causes and remedies are also included on this chart.

TABLE 5-5 REPLACEABLE PARTS LIST

SIGNAL - 2nd IF FILTER, IF DETECTOR

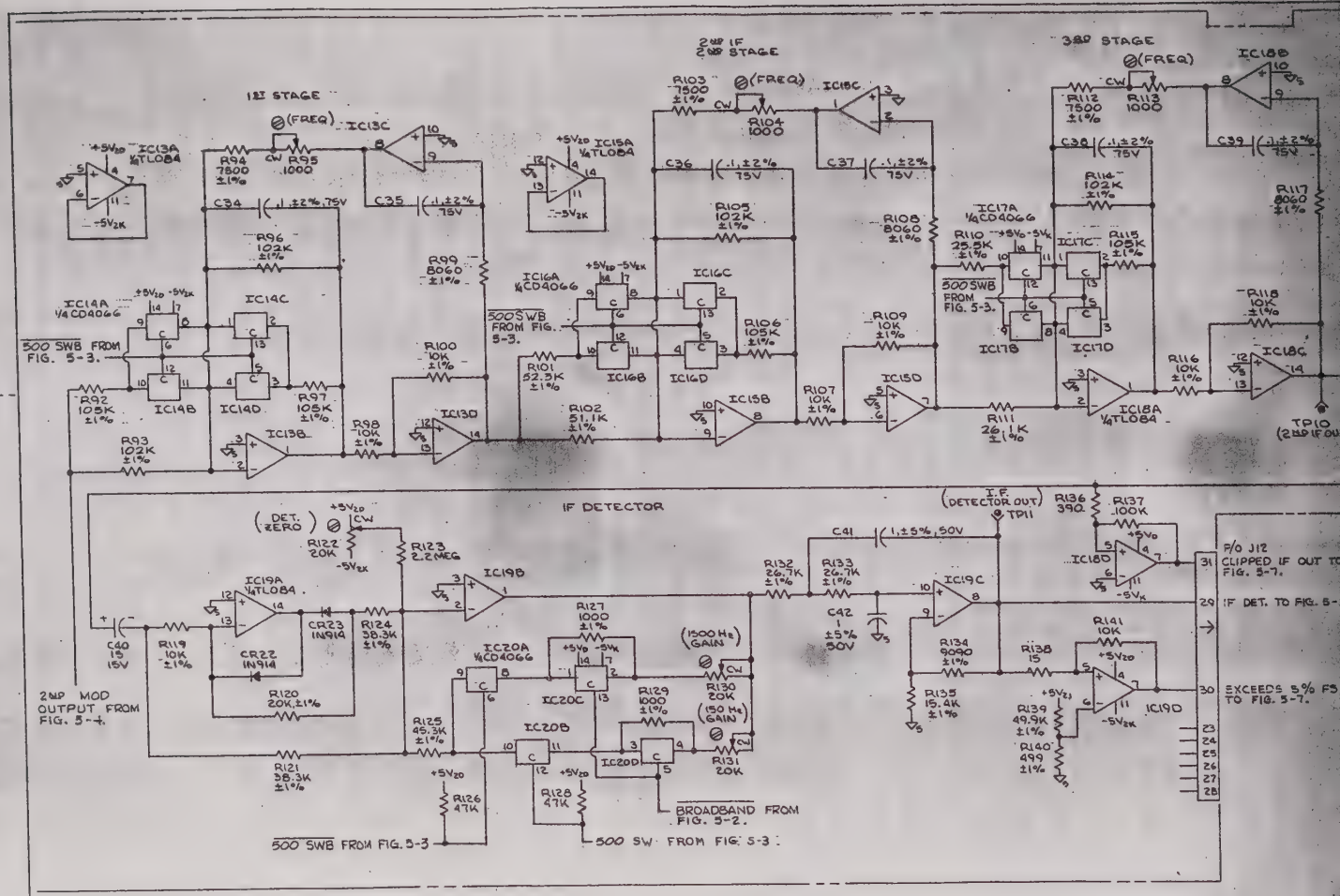
P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

SYMBOL	DESCRIPTION
C34	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C35	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C36	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C37	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C38	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C39	Capacitor, .1 mF, ±2%, 75V, F-Dyne #PS-11
C40	Capacitor, 15 mF, 15V, Sprague #196D
C41	Capacitor, 1 mF, ±5%, 50V, F-Dyne #MPE-13
C42	Capacitor, 1 mF, ±5%, 50V, F-Dyne #MPE-13
CR22	Diode, 1N914
CR23	Diode, 1N914
IC13	Integrated Circuit, TL084
IC14	Integrated Circuit, CD4066
IC15	Integrated Circuit, TL084
IC16	Integrated Circuit, CD4066
IC17	Integrated Circuit, CD4066
IC18	Integrated Circuit, TL084
IC19	Integrated Circuit, TL084
IC20	Integrated Circuit, CD4066
~~R92~~	~~Resistor, 61.9KΩ, ±1%, 1/8W~~
~~R93~~	~~Resistor, 316KΩ, ±1%, 1/8W~~
R94	Resistor, 7500Ω, ±1%, 1/8W
R95	Resistor, Variable, 1000Ω, Beckman #72PM
~~R96~~	~~Resistor, 316KΩ, ±1%, 1/8W~~
~~R97~~	~~Resistor, 61.9KΩ, ±1%, 1/8W~~
R98	Resistor, 10KΩ, ±1%, 1/8W
R99	Resistor, 8060Ω, ±1%, 1/8W
R100	Resistor, 10KΩ, ±1%, 1/8W
~~R101~~	~~Resistor, 31.6KΩ, ±1%, 1/8W~~
~~R102~~	~~Resistor, 158KΩ, ±1%, 1/8W~~
R103	Resistor, 7500Ω, ±1%, 1/8W
R104	Resistor, Variable, 1000Ω, Beckman #72PM
~~R105~~	~~Resistor, 316KΩ, ±1%, 1/8W~~
~~R106~~	~~Resistor, 61.9KΩ, ±1%, 1/8W~~
R107	Resistor, 10KΩ, ±1%, 1/8W
R108	Resistor, 8060Ω, ±1%, 1/8W
R109	Resistor, 10KΩ, ±1%, 1/8W
~~R110~~	~~Resistor, 15.4KΩ, ±1%, 1/8W~~
~~R111~~	~~Resistor, 80.6KΩ, ±1%, 1/8W~~
R112	Resistor, 7500Ω, ±1%, 1/8W
R113	Resistor, Variable, 1000Ω, Beckman #72PM
~~R114~~	~~Resistor, 316KΩ, ±1%, 1/8W~~

TABLE 5-5 REPLACEABLE PARTS LIST

SIGNAL - 2nd IF FILTER, IF DETECTOR

SYMBOL	DESCRIPTION
R115	Resistor, 61.9KΩ, ±1%, 1/8W
R116	Resistor, 10KΩ, ±1%, 1/8W
R117	Resistor, 8060Ω, ±1%, 1/8W
R118	Resistor, 10KΩ, ±1%, 1/8W
R119	Resistor, 10KΩ, ±1%, 1/8W
R120	Resistor, 20KΩ, ±1%, 1/8W
R121	Resistor, 38.3KΩ, ±1%, 1/8W
R122	Resistor, Variable, 20KΩ, Beckman #72PM
R123	Resistor, 2.2 MegΩ, ±10%, 1/4W, AB Type CB
R124	Resistor, 38.3KΩ, ±1%, 1/8W
R125	Resistor, 45.3KΩ, ±1%, 1/8W
R126	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R127	Resistor, 1000Ω, ±1%, 1/8W
R128	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R129	Resistor, 1000Ω, ±1%, 1/8W
R130	Resistor, Variable, 20KΩ, Beckman #72PM
R131	Resistor, Variable, 20KΩ, Beckman #72PM
R132	Resistor, 26.7KΩ, ±1%, 1/8W
R133	Resistor, 26.7KΩ, ±1%, 1/8W
R134	Resistor, 9090Ω, ±1%, 1/8W
R135	Resistor, 15.4KΩ, ±1%, 1/8W
R136	Resistor, 390Ω, ±10%, 1/4W, AB Type CB
R137	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R138	Resistor, 15Ω, ±10%, 1/4W, AB Type CB
R139	Resistor, 49.9KΩ, ±1%, 1/8W
R140	Resistor, 499Ω, ±1%, 1/8W
R141	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R52	Resistor, 127 kΩ 1/8 W ±1%
R93	Resistor, 102 kΩ 1/8 W ±1%
R96	Resistor, 102 kΩ 1/8 W ±1%
R92	Resistor, 105 kΩ 1/8 W ±1%
R97	Resistor, 105 kΩ 1/8 W ±1%
R105	Resistor, 102 kΩ 1/8 W ±1%
R106	Resistor, 105 kΩ 1/8 W ±1%
R115	Resistor, 105 kΩ 1/8 W ±1%
R101	Resistor, 52.3 kΩ 1/8 W ±1%
R102	Resistor, 51.1 kΩ 1/8 W ±1%
R110	Resistor, 25.5 kΩ 1/8 W ±1%
R111	Resistor, 26.1 kΩ 1/8 W ±1%
R114	Resistor, 102 kΩ 1/8 W ±1%


2ND IF 2ND STAGE
3RD STAGE
1ST STAGE
IF DETECTOR
500 SWB FROM FIG. 5-3.
2ND MOD OUTPUT FROM FIG. 5-4.
BROADBAND FROM FIG. 5-2.
500 SW FROM FIG. 5-3
P/O J12 CLIPPED IF OUT TO FIG. 5-7.
IF DET. TO FIG. 5-
EXCEEDS 5% FS TO FIG. 5-7.
TP10 (2ND IF OU

TITLE: SCHEMATIC, SIGNAL - 2ND IF FILTER, IF DETECTOR

DRAWN	DATE	CODE IDENT NO	
BPC	4-11-89	13048	Scientific-Atlanta, I
CHK	APVD		
MODEL		SHEET	DWG NO

TABLE 5-7 REPLACEABLE PARTS LIST

CONTROL - VCO, REFRESH, TRACK

SYMBOL	DESCRIPTION
IC13	Integrated Circuit, CD4066
IC14	Integrated Circuit, Scientific-Atlanta A-5659-2
IC15	Integrated Circuit, AD537JH
IC16	Integrated Circuit, CD4066
IC17	Integrated Circuit, CD4013
L1	Coil, Scientific-Atlanta A-10282-2
L2	Coil, Scientific-Atlanta A-10282-2
Q1	Transistor, MPSA18
Q2	Transistor, 2N5953
R16	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R17	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R18	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R19	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R20	Resistor, 100Ω, ±10%, 1/4W, AB Type CB
R21	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R22	Resistor, 200KΩ, ±1%, 1/8W
R23	Resistor, 200KΩ, ±1%, 1/8W
R24	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R25	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R26	Resistor, 120KΩ, ±10%, 1/4W, AB Type CB
R27	Resistor, 6.8 MegΩ, ±10%, 1/4W, AB Type CB
R28	Resistor, 10 MegΩ, ±10%, 1/4W, AB Type CB
R29	Resistor, 270Ω, ±10%, 1/4W, AB Type CB
R30	Resistor, 220KΩ, ±10%, 1/4W, AB Type CB
R31	Resistor, 1 MegΩ, ±10%, 1/4W, AB Type CB
R32	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R33	Resistor, 13KΩ, ±1%, 1/8W
R34	Resistor, 10KΩ, ±1%, 1/8W
R35	Resistor, 10KΩ, ±1%, 1/8W
R36	Resistor, 150KΩ, ±10%, 1/4W, AB Type CB
R37	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R38	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R39	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R40	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R41	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
~~R42~~	~~Resistor, 243KΩ, ±1%, 1/8 W~~
~~R43~~	~~Resistor, Variable, 50KΩ, Beckman #68X~~
R44	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
~~R45~~	~~Resistor, 26.7KΩ, ±1%, 1/8W~~
R46	Resistor, Variable, 500Ω, Beckman #68X
R47	Resistor, 35.7KΩ, ±1%, 1/8W
R48	Resistor, 10 MegΩ, ±10%, 1/4W, AB Type CB

TABLE 5-7 REPLACEABLE PARTS LIST

CONTROL - VCO, REFRESH, TRACK

SYMBOL	DESCRIPTION
R49	Resistor, 15.8KΩ, ±1%, 1/8W
R50	Resistor, 20KΩ, ±1%, 1/8W
R51	Resistor, 1 MegΩ, ±1%, 1/8W
R52	Resistor, 10KΩ, ±10%, 1/4W, AB Type CB
R53	Resistor, Variable, 10KΩ, Beckman #68X
R54	Resistor, 15.8KΩ, ±1%, 1/8W
R55	Resistor, 8200Ω, ±10%, 1/4W, AB Type CB
R56	Resistor, 330KΩ, ±10%, 1/4W, AB Type CB
R57	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R58	Resistor, 100Ω, ±1%, 1/8W
R59	Resistor, 100Ω, ±1%, 1/8W
R60	Resistor, 4700Ω, ±10%, 1/4W, AB Type CB
R61	Resistor, 60.4KΩ, ±1%, 1/8W
R62	Resistor, 47KΩ, ±10%, 1/4W, AB Type CB
R63	Resistor, 60.4KΩ, ±1%, 1/8W
R64	Resistor, 22KΩ, ±10%, 1/4W, AB Type CB
R122	Resistor, 15.8KΩ, ±1%, 1/8W
C12	Capacitor, 0.056 μf, 100 V, ±10%
R12	Resistor, 68.1 kΩ, 1/8 W ±1%
R42	Potentiometer, 20 kΩ
R45	Resistor, 36.5 kΩ, 1/8 W ±1%
IC20	Integrated circuit, CD4018
IC222	Integrated Circuit, CD4081

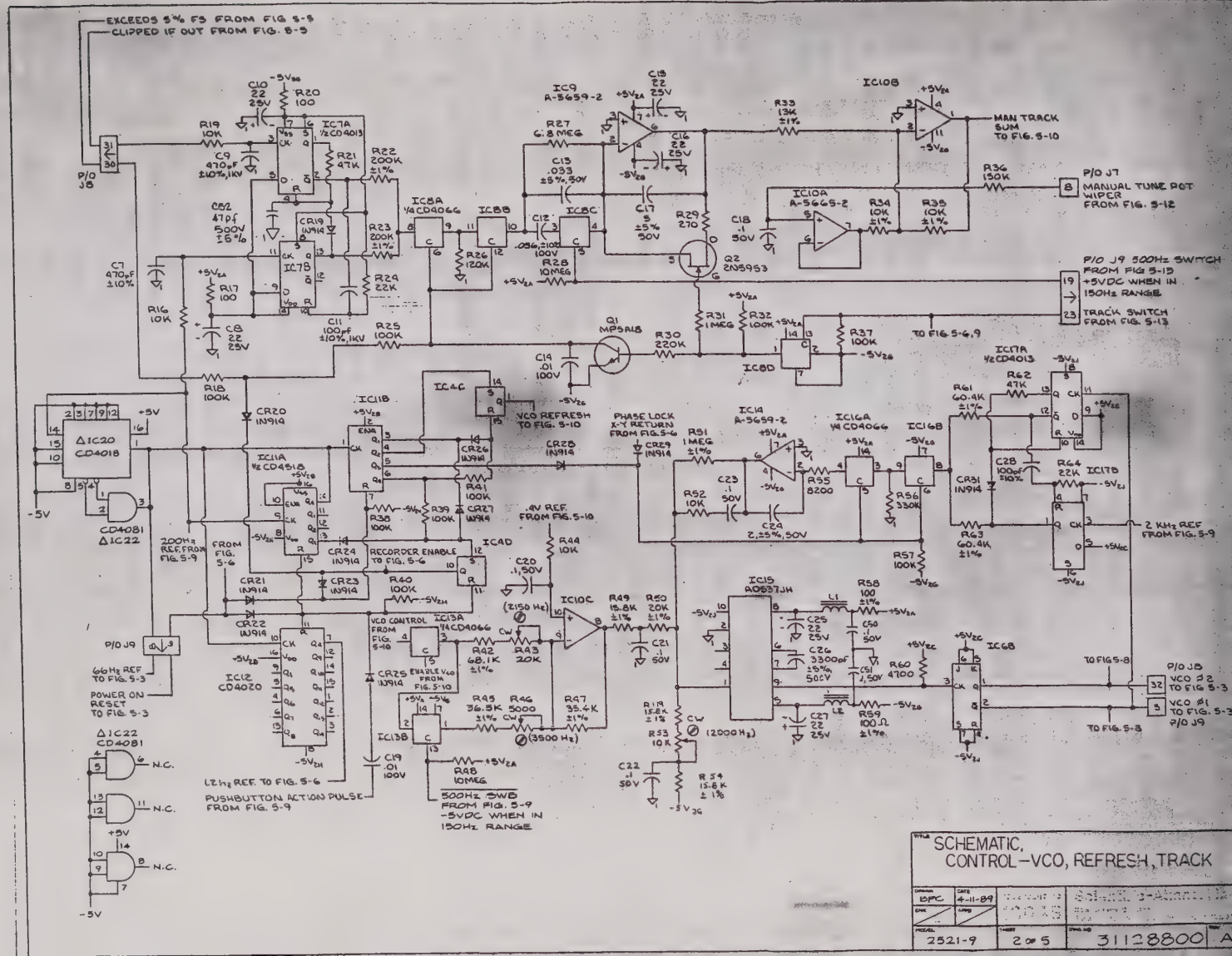

EXCEEDS 5% FS FROM FIG 5-9
CLIPPED IF OUT FROM FIG. 5-5
P/O J8
MAN TRACK SUM TO FIG. 5-10
P/O J7 MANUAL TUNE POT WIPER FROM FIG. 5-12
P/O J9 500Hz SWITCH FROM FIG 5-13 +5VDC WHEN IN 150Hz RANGE
TRACK SWITCH FROM FIG. 5-13
TO FIG 5-6,9
VCO REFRESH TO FIG. 5-10
PHASE LOCK X-Y RETURN FROM FIG. 5-6
.4V REF. FROM FIG. 5-10
2 KHz REF FROM FIG. 5-9
200Hz REF. FROM FIG. 5-9
FROM FIG. 5-6
RECORDER ENABLE TO FIG. 5-6
VCO CONTROL FROM FIG. 5-10
ENABLE VCO FROM FIG. 5-10
66Hz REF TO FIG. 5-3
POWER ON RESET TO FIG. 5-3
12Hz REF. TO FIG. 5-6
PUSHBUTTON ACTION PULSE FROM FIG. 5-9
500Hz SWB FROM FIG. 5-9 -5VDC WHEN IN 150Hz RANGE
P/O J8 VCO Ø2 TO FIG 5-3
VCO Ø1 TO FIG. 5-3
TO FIG 5-8
SCHEMATIC, CONTROL–VCO, REFRESH, TRACK
BPC
4-11-89
2521-9
2 of 5
31128800
A

TABLE 5-3 REPLACEABLE PARTS LIST

SIGNAL - BROADBAND DETECTOR 1st MODULATOR, CALIBRATE

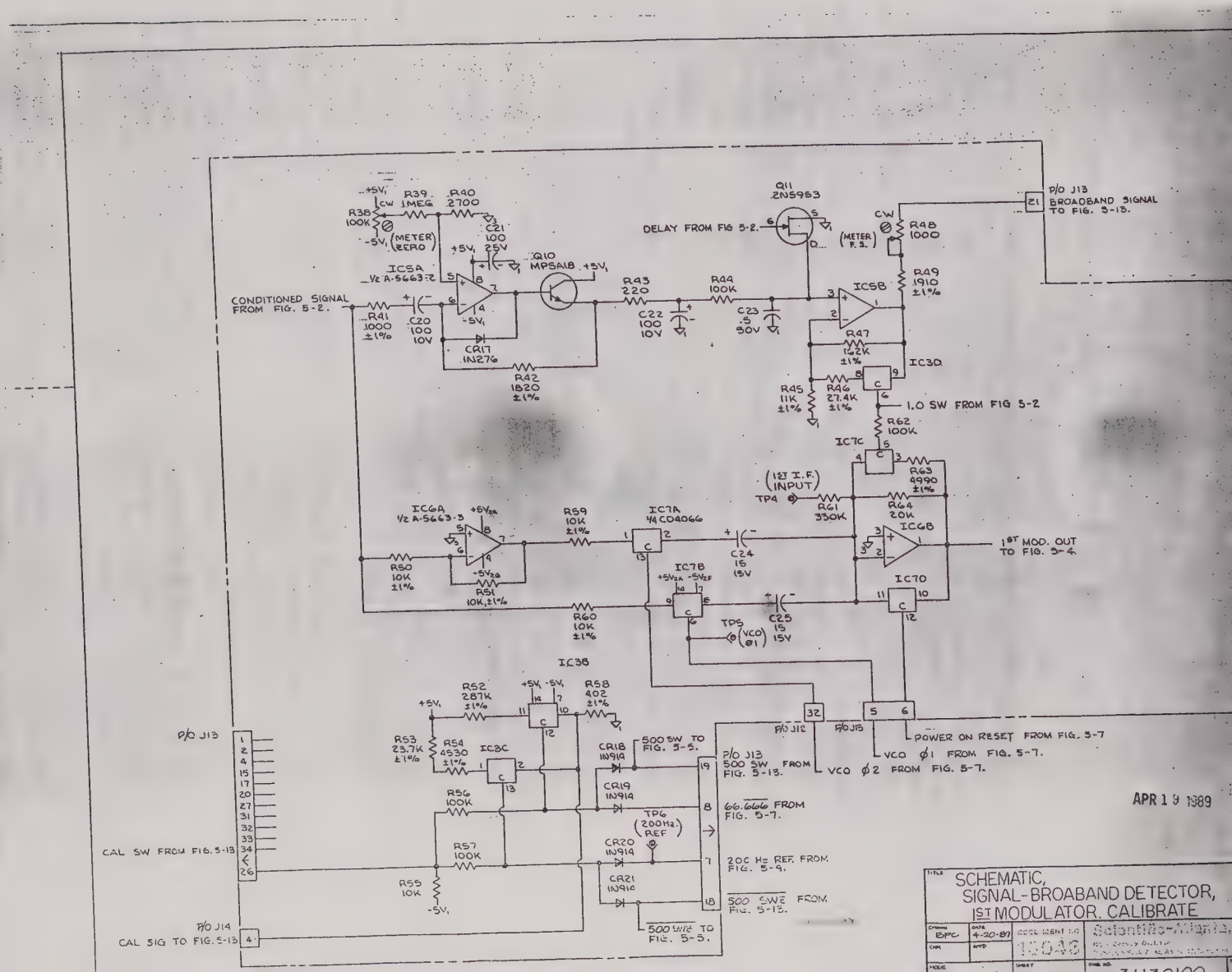
P/O Signal Board Assembly Scientific-Atlanta #10263 consisting of:

SYMBOL	DESCRIPTION
C20	Capacitor, 100 mF, 10V, Sprague #196D
C21	Capacitor, 100 mF, 25V, Panasonic #ECEAIEV101S
C22	Capacitor, 100 mF, 10V, Sprague #196D
C23	Capacitor, .5 mF, ±20%, 50V, F-Dyne #MPE-13
C24	Capacitor, 15 mF, 15V, Sprague #196D
C25	Capacitor, 15 mF, 15V, Sprague #196D
CR17	Diode, 1N276
CR18	Diode, 1N914
CR19	Diode, 1N914
CR20	Diode, 1N914
CR21	Diode, 1N914
IC3	Integrated Circuit, CD4066 (see Table 5-2)
IC5	Integrated Circuit, Scientific-Atlanta A-5663-2
IC6	Integrated Circuit, Scientific-Atlanta A-5663-3
IC7	Integrated Circuit, CD4066
Q10	Transistor, MPSA18
Q11	Transistor, 2N5953
R38	Resistor, Variable, 100KΩ, Beckman #72PM
R39	Resistor, 1MegΩ, ±10%, 1/4W, AB Type CB
R40	Resistor, 2700Ω, ±10%, 1/4W, AB Type CB
R41	Resistor, 1000Ω, ±1%, 1/8W
R42	Resistor, 1820Ω, ±1%, 1/8W
R43	Resistor, 220Ω, ±10%, 1/4W, AB Type CB
R44	Resistor, 100KΩ, ±10%, 1/4W, AB Type CB
R45	Resistor, 11KΩ, ±1%, 1/8W
R46	Resistor, 27.4KΩ, ±1%, 1/8W
R47	Resistor, 162KΩ, ±1%, 1/8W
R48	Resistor, Variable, 1000Ω, Beckman #72PM
R49	Resistor, 1910Ω, ±1%, 1/8W
R50	Resistor, 10KΩ, ±1%, 1/8W
R51	Resistor, 10KΩ, ±1%, 1/8W
~~R52~~	~~Resistor, 287KΩ, ±1%, 1/8W~~
R53	Resistor, 23.7KΩ, ±1%, 1/8W
R54	Resistor, 4530Ω, ±1%, 1/8W
R55	Resistor, 10KΩ, ±10%, 1/4W AB Type CB
R56	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R57	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R58	Resistor, 402Ω, ±1%, 1/8W
R59	Resistor, 10KΩ, ±1%, 1/8W
R60	Resistor, 10KΩ, ±1%, 1/8W

TABLE 5-3 REPLACEABLE PARTS LIST

SIGNAL - BROADBAND DETECTOR 1st MODULATOR, CALIBRATE

SYMBOL	DESCRIPTION
R61	Resistor, 330KΩ, ±10%, 1/4W AB Type CB
R62	Resistor, 100KΩ, ±10%, 1/4W AB Type CB
R63	Resistor, 4990Ω, ±1%, 1/8W
R64	Resistor, 20KΩ, ±10%, 1/4W, AB Type CB
TP4	Jack, Test Point, Johnson #105-0572-001
TP5	Jack, Test Point, Johnson #105-0572-001
TP6	Jack, Test Point, Johnson #105-0572-001
R52	Resistor, 127 kΩ, ± 1%


+5V1
R39 1MEG
R40 2700
R38 100K
(METER) ZERO
-5V1
C21 100 25V
+5V1
Q10 MPSA18
+5V1
IC5A 1/2 A-5663-2
CONDITIONED SIGNAL FROM FIG. 5-2.
R41 1000 ±1%
C20 100 10V
CR17 IN276
R42 1820 ±1%
-5V1
R43 220
C22 100 10V
R44 100K
C23 .5 50V
Q11 2N5963
DELAY FROM FIG 5-2.
(METER F.S.)
CW
R48 1000
R49 1910 ±1%
IC5B
R47 12.2K ±1%
IC3D
R45 11K ±1%
R46 27.4K ±1%
1.0 SW FROM FIG 5-2
R62 100K
IC7C
P/O J13
21
BROADBAND SIGNAL TO FIG. 5-13.
(1ST I.F.) INPUT
TP4
R61 330K
R63 9990 ±1%
R64 20K
IC6B
1ST MOD. OUT TO FIG. 5-4.
IC6A 1/2 A-5663-3
+5V2A
-5V2A
R59 10K ±1%
IC7A 14CD4066
C24 15 15V
R50 10K ±1%
R51 10K, ±1%
IC7B
+5V2A -5V2F
IC7D
R60 10K ±1%
TP5 (VCO Ø1)
C25 15 15V
IC3B
R52 287K ±1%
+5V1
-5V1
R58 402 ±1%
P/O J12
P/O J13
32
5
6
POWER ON RESET FROM FIG. 5-7
VCO Ø1 FROM FIG. 5-7.
VCO Ø2 FROM FIG. 5-7.
P/O J13
500 SW FROM FIG. 5-13.
APR 19 1989
P/O J13
1
2
4
15
17
20
27
31
32
33
34
26
CAL SW FROM FIG. 5-13
R53 23.7K ±1%
R54 4530 ±1%
IC3C
500 SW TO FIG. 5-5.
CR18 IN914
CR19 IN914
R56 100K
TP6 (200Hz REF)
CR20 IN914
R57 100K
CR21 IN914
R55 10K
-5V1
19
8
7
18
66.6666 FROM FIG. 5-7.
200 Hz REF. FROM FIG. 5-9.
500 SWE FROM FIG. 5-13.
P/O J14
CAL SIG TO FIG. 5-13
4
500 SWE TO FIG. 5-5.
SCHEMATIC, SIGNAL-BROADBAND DETECTOR, 1ST MODULATOR. CALIBRATE
BJC
4-20-87
Scientific-Atlanta

Scientific-Atlanta Service Information

Scientific-Atlanta has sales and service centers around the world. In addition, an international network of sales representatives is available to assist you anywhere in the world.

Product Support Programs

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At Scientific-Atlanta, we are committed to supporting the instruments we sell. This philosophy is demonstrated through a world-wide sales and service organization which provides a variety of services to our customers.

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Scientific-Atlanta maintains a network of service centers around the world. These centers are staffed and equipped to handle most maintenance requirements. In addition, the service center can provide technical assistance on problems related to the application, operation, or maintenance of our products.

- Service representatives are factory trained on each product.
- Specialized knowledge and test equipment is available to provide local repair with minimum downtime.
- The service representatives have the experience to provide on-site calibration and maintenance of individual instruments or entire systems.

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If an instrument develops a defect within the warranty period, contact your Scientific-Atlanta service center. Your Service Representative will help determine the best course of action for effecting the repair of your equipment; all without parts or labor expense to you.

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An annual service agreement is an economical and effective way to assure continued high instrument performance. Periodic scheduled maintenance and calibration is the best insurance against equipment failure. It is a cost-effective means of preventing expensive production interruptions or delays in development programs. You are assured of timely, competent service without the expense of maintaining in-house maintenance capability, specialized test equipment, and replacement parts inventories.

Some of the outstanding advantages of an Annual Service Agreement are:

- Regularly scheduled maintenance and calibration.
- Reduced labor rates — approximately 20% saving over unscheduled field service.
- Quick response on emergency service — normally within 48 hours.
- Facilitates maintenance budgeting.
- Minimizes paperwork — one purchase order covers the entire year.
- On-site service of instruments or entire system — reduces downtime, eliminates problems related to sending individual instruments to the calibration laboratory.

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Field Service is available to assist you with stubborn maintenance problems, installations, and other technical problems. If field service is required, contact your Scientific-Atlanta service center.

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In some cases it is more efficient or cost effective to return equipment to our service center. Your Service Representative will gladly work with you to determine when this is necessary and will provide you with shipping instructions.

Replacement Parts

Each service center maintains inventories of most replacement parts for current standard products. In most cases, emergency orders for parts, printed circuit boards, subassemblies, and supplies can be filled within 24 hours. Ordering parts from Scientific-Atlanta provides you with a single source of supply and assurance of part compatibility.

When ordering parts from Scientific-Atlanta, please provide a description, part number, model number, and serial number.

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